



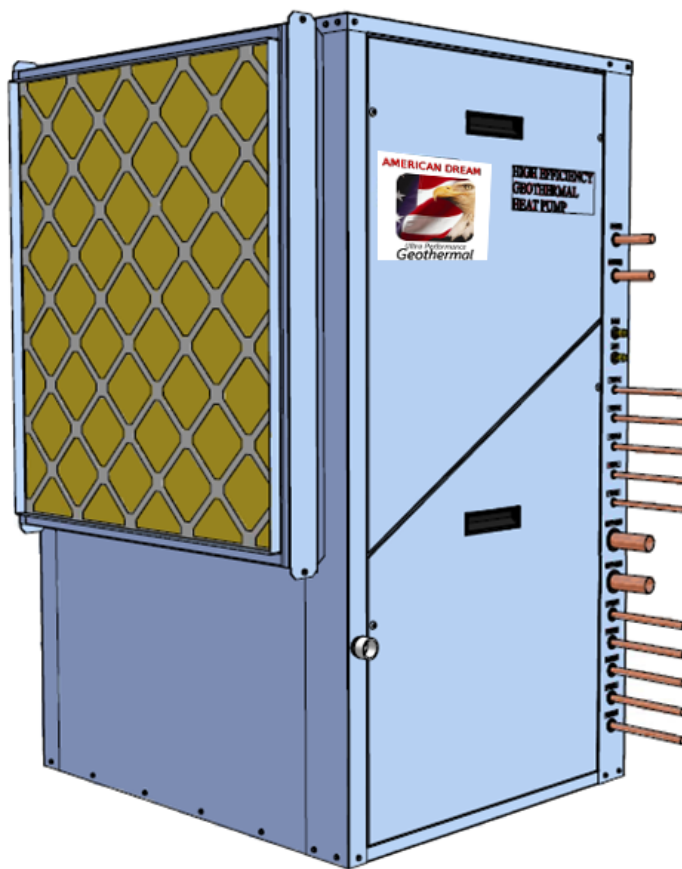
AMERICAN DREAM Ultra Performance Geothermal™



Installation and Service Manual

AMERICAN DREAM Freon-
Copper-Series
Triple Function™

Freon-Copper Triple Function Heat Pumps



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Document Number: 000744MAN-02



SAFETY PRECAUTIONS



WARNING: Ensure all access panels are in place and properly secured before applying power to the unit. Failure to do so may cause risk of electrical shock.

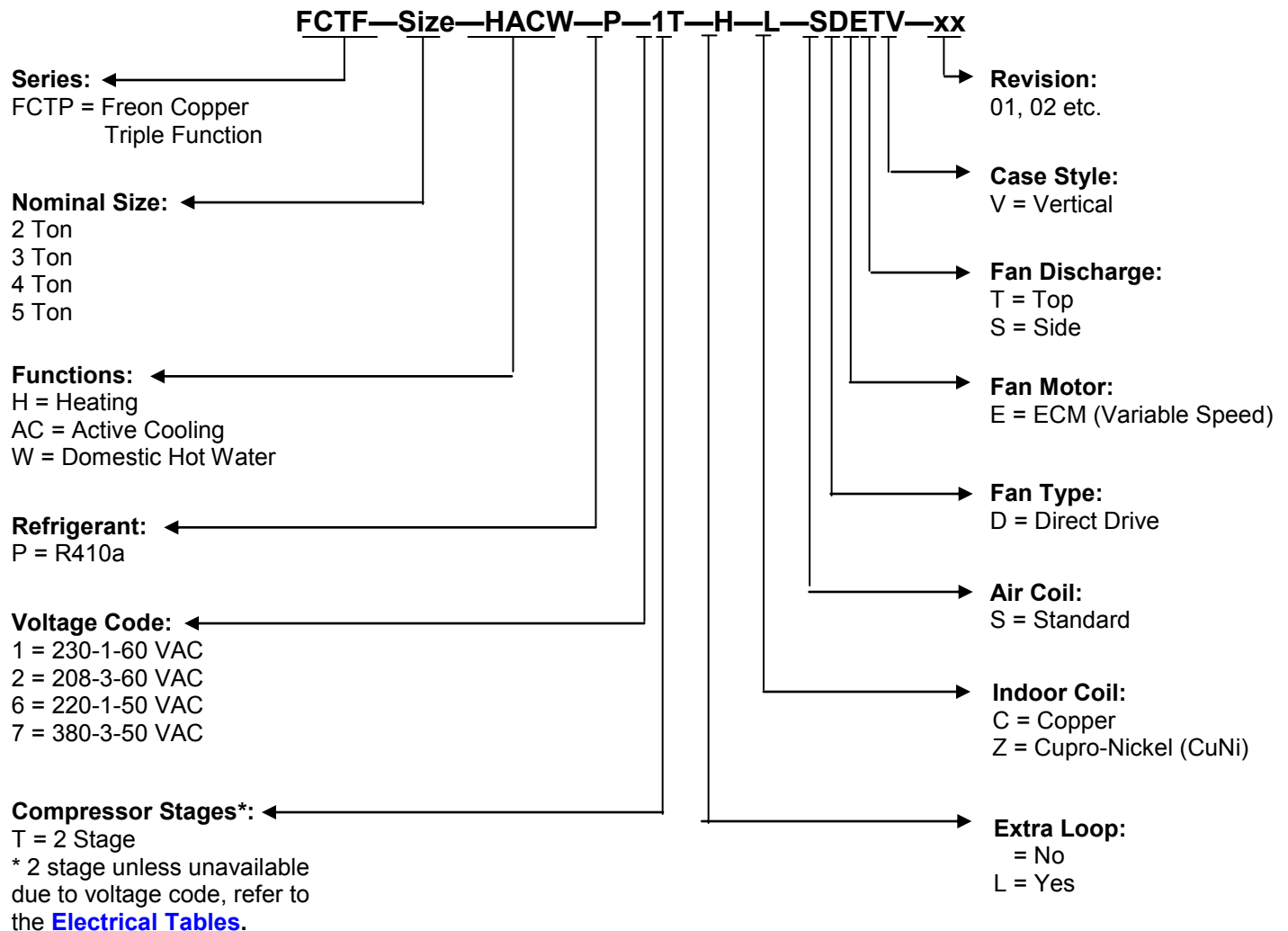
WARNING: Before performing service or maintenance on the heat pump system, ensure all power sources are DISCONNECTED. Electrical shock can cause serious personal injury or death.

WARNING: Heat pump systems contain refrigerant under high pressure and as such can be hazardous to work on. Only qualified service personnel should install, repair, or service the heat pump.

CAUTION: Safety glasses and work gloves should be worn at all times whenever a heat pump is serviced. A fire extinguisher and proper ventilation should be present whenever brazing is performed.

CAUTION: Venting refrigerant to atmosphere is illegal. A proper refrigerant recovery system must be employed whenever repairs require removal of refrigerant from the heat pump.

MODEL NOMENCLATURE



APPLICATION TABLE												
SIZE	FUNCTION	REFRIGERANT	VOLTAGE	STAGES	EXTRA LOOP	INDOOR COIL	FAN/CASE	REVISIONS				
3 Ton	HACW	P	1	T	BLANK or H	C or Z	SDETV	02				
			2	T				02				
			6	S				02				
			7	T				02				
4 Ton	HACW	P	1	T	BLANK or H	C or Z	SDETV	02				
			2	T				02				
			6	S				02				
			7	T				02				
5 Ton	HACW	P	1	T	BLANK or H	C or Z	SDETV	02				
			2	T				02				
			6	S				02				
			7	T				02				
This manual applies only to the models and revisions listed in this table												

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Installation Information

UNIT DESCRIPTION

Your American Dream Geothermal unit is a high efficiency two stage triple function heat pump with R410a refrigerant. It extracts and rejects heat from the earth via direct contact with copper loops, eliminating the need for a secondary heat exchanger and associated components. The FCTF unit can provide air heating, air cooling, and hydronic heating.

Freon Copper units require less "loop" per ton and are more efficient than conventional ground loop systems. The reduced thermal resistance between the earth and the refrigerant circuit provides better heat transfer, resulting in a higher suction pressure and increased output.

An electrically commutated (ECM) fan with several speed options is standard. The motor has a soft start function for improved efficiency and reduced wear.

The unit has several key features that are described in the specifications document for the particular heat pump. Please request a copy if desired or visit www.AmericanDreamGeothermal.com

UNPACKING THE UNIT

When the heat pump reaches its destination it should be unpacked to determine if any damage has occurred during shipment. Any visible damage should be noted on the carrier's freight bill and a suitable claim filed at once.

The heat pump is well constructed and every effort has been made to ensure that it will arrive intact, however it is in the customer's best interest to examine the unit thoroughly when it arrives.

OPTIMUM PLACEMENT

For air units, to achieve the greatest efficiency, the heat pump should be centrally located in the home with respect to the conditioned space. This design provides the utmost in economy and comfort and usually can be accomplished in harmony with the design of the home. A heating system cannot be expected to produce an even warmth throughout the household when it is located at one end of the structure and the warm air is transmitted with uninsulated metal ductwork.

If possible the access panels should remain clear of obstruction for a distance of **two feet** to facilitate servicing and general maintenance.

Raising the heat pump off the floor a few inches is generally a good practice since this will prevent rusting of the bottom panel of the unit. We recommend that the heat pump be placed on a piece of 2" thick styrofoam. The styrofoam will smooth out any irregularities in the cement floor and deaden any compressor noise emitted from the bottom of the cabinet.

AMERICAN DREAM Ultra Performance® heat pumps have an air-filter rack which can be installed with the removable end (where the filter is inserted) on either side to facilitate changing the filter.

ELECTRICAL CONNECTIONS

The heat pump has a concentric 1.093" / 0.875" knockout for power supply connection to the electrical box, as well as one

for connection to the circulator pump module for ground loop applications. There are two 1/2" openings with plastic grommets (grommet hole is 3/8") in the upper section of the electrical box, one for the thermostat connections, and one for the optional plenum heater connections.

A schematic diagram and electrical box layout diagram (ELB) can be found inside the electrical box cover of the unit as well as in the [Model Specific](#) section of this manual. The Electrical Tables in the [Model Specific](#) section and the ELB diagram contain information about the size of wire for the connections, as well as the recommended breaker size. **A properly qualified electrician should be retained to make the connections to the heat pump and associated controls. The connections to the heat pump MUST CONFORM TO LOCAL CODES.**

THERMOSTAT REQUIREMENTS

The FCTF-Series unit includes a three-stage heating and two stage cooling thermostat with relay outputs for proper air mode operation. **Triac output thermostats are incompatible with the control board in the heat pump.** The stages are S1 = heat pump stage 1, S2 = heat pump stage 2, S3 = electric auxiliary (heating only). One can be purchased with the unit, or other thermostats with the same number of stages can be used.

TABLE 1 - Thermostat to FCTF Control Box Signals

Signal	Description
C	24VAC Common (Ground)
G	Fan low speed (for air circulation)
Y ₁	Heat Pump Stage 1 (Compressor stage 1)
R _H	24VAC Hot
L	Fault (24VAC when fault condition)
W ₂	Heat Pump Stage 3 (auxiliary heat) / Emergency Heat
O/B/W ₁	Cooling Mode (reversing valve)
Y ₂	Heat Pump Stage 2 (Compressor stage 2)

The thermostat signals connect to the geothermal unit Control box as per **TABLE 1**.

AQUASTAT REQUIREMENTS

TABLE 2 - Aquastat to FCTF Control Box Signals

Signal*	Description
CA	24VAC Common (Ground)
RA	24VAC Hot
Y1A	Heat Pump Stage 1 (Compressor stage 1)
Y2A	Heat Pump Stage 2 (Compressor stage 2)
* Refer to 000139CDG (included with the FCTF Control Box) for a complete description of the connections to the aquastat.	

For water mode operation, a two stage aquastat is required to provide the appropriate control signals. The connections to the FCTF Control Box are shown in **TABLE 2**.

The aquastat can be placed anywhere within the range of the probe cable. The probe should be inserted into a dry well in or near the top of the tank for optimal operation ([refer to drawing 000533PDG](#)). If a dry well is not available, it may be possible to fix the probe to the tank inside the insulation.

TABLE 3 shows typical settings for the aquastat. The settings may be changed as desired; however, the setpoint

TABLE 3 - Typical Aquastat Settings				
	Stage 1**		Stage 2**	
Item	°F	°C	°F	°C
Setpoint	115	46	105	41
Delta	5	3	5	3
Activation *	110	43	100	38
*Activation is indirectly set by the Setpoint and Delta values ** All values must be set identical for both stages				

should not exceed **120°F (49°C)**; Exceeding this setpoint limit will cause the heat pump operating pressures to approach the safety control settings, possibly causing nuisance shut downs.

If only floor zones are being heated, it is highly recommended to drop each of the setpoints by 15°F (8°C) for increased efficiency.

It is recommended that a buffer tank with electric elements be selected to provide auxiliary / backup heat. The tank element thermostats can be set to a low value of around 60°F (15°C) which will prevent the hydronic system from becoming too cold should there be a failure in the heating system.

Drawing 000344CDG shows how a typical zone system would be setup with the FCTF unit. The zone controls and heat pump operate independently, there are no connections between the two systems.

TWO STAGE CONTROL BOX

The Two Stage Control Box is the interface between the controls (thermostat and aquastat) and the heat pump. It's main function is to provide the signal manipulation required to operate the fan or the Indoor Loop Circulator as required based on the signals received from the controls. It also contains a contactor for power connections to the Indoor Loop Circulator.

The connections between the control box and the heat pump are shown in **TABLE 4**. Three documents are shipped with the Control Box: **000739SCH**, **000740CDG** and

TABLE 4 - FCTF Two Stage Control Box to Heat Pump Signals	
Signal	Description
C	24VAC Common (Ground)
G	Fan low speed (for air circulation)
Y₁	Heat Pump Stage 1 (Compressor stage 1)
R_H	24VAC Hot
L	Fault (24VAC when fault condition)
W₂	Heat Pump Stage 3 (auxiliary heat) / Emergency Heat
O/B/W₁	Cooling Mode (reversing valve)
Y₂	Heat Pump Stage 2 (Compressor stage 2)
E1	Fan Auxiliary/Emergency Speed Control (In)
E2	Fan Auxiliary/Emergency Speed Control (Out)
FC	Fan Contactor

000741INF. They contain all the information required to complete the Two Stage Control Box connections, as well as information on how the control box operates.

AIR FLOW REDUCTION AND PLENUM HEATER CONNECTIONS

TABLE 5 lists the remaining four terminals on the heat pump terminal strip. These signals are separate from the Control Box. The AR₁ and AR₂ terminals are the airflow reduction signal. See the **FAN MOTOR** section for more information on therm. The I and 1 terminals are the dry contacts for the plenum

TABLE 5 - Remaining Signal Descriptions	
Signal	Description
AR₁	Airflow Reduction*
AR₂	Airflow Reduction*
I	Plenum Heater dry contact
1	Plenum Heater dry contact
* Connect AR ₁ to AR ₂ with a dry contact to reduce the airflow by 15%. Refer to the Fan Motor sub-section for more information.	

heater. Connect these to the C and 1 terminals of the plenum heater. Refer to the electrical box diagram (ELB) of the heat pump or the diagram on the cover of the plenum heater for more information.

NOTE: Some models are not available in two-stage at the present time (see **Electrical Tables**). The Y₂ signal is not used for these units

INDOOR LOOP CIRCULATOR WIRING

The Indoor Loop circulator provides flow between the heat pump and the buffer tank. The Two Stage Control Box has provisions for connecting the Indoor Circulator so that it will be turned on whenever the heat pump is in water heat mode and the compressor operates. Connect line voltage (115 or 230VAC) to the terminals marked L1 and L2 of the Indoor Circulator Contactor. Connect the Indoor Loop circulator to the terminals marked P1 and P2. Ensure that the line voltage and circulator voltage rating are the same.

FAN MOTOR

The unit is equipped with a direct drive ECM fan motor for maximum efficiency. The motor features a soft start which further improves efficiency by eliminating inrush current and provides a smooth, quiet ramp up to speed. The motor will maintain the programmed air flow up to the maximum external static

TABLE 6 - Airflow Selections	
Position	Airflow
LOW	-12%
MED	-6%
HIGH	Nominal
MAX	+6%

value. Refer to the **APPENDIX A: ECM Fan Airflow Tables**.

The air flow can be set to four different levels by changing the position on the Air Flow board located in the electrical box. The four levels are indicated in **TABLE 6**. The actual air flow

values can be found in **APPENDIX A**.

Units are shipped with the **MED** position selected for nominal air flow. The air flow can be further reduced by 15% by making a dry contact across AR₁ and AR₂ on the terminal strip. This can be used for applications that have multiple zones, or retrofits with undersized ductwork, to help reduce air flow noise in the ductwork. It is recommended that airflow reduction only be used with the High or Max air flow setting. Care should be taken to ensure that the unit does not trip a safety control in heating or cooling mode if the 15% reduction is used in conjunction with the Med or Low air flow setting.

CONTROL TRANSFORMER

The low voltage controls for all models are powered by a 100VA transformer with primary and secondary fuses for circuit protection. Should a fuse blow, determine the problem and rectify it before replacing the fuse.

SAFETY CONTROLS

The heat pump has two built in safety controls which are designed to protect the unit from situations which could damage it should the operation of the refrigeration circuit fall outside the allowable operating range.

A. Low Pressure Control

The low pressure control monitors the compressor suction pressure and will shut the compressor down if the refrigerant evaporating pressure becomes too low.

There only reason this control would activate in response to the operating conditions of the unit in the heating mode would be due to a ruptured loop, causing a low refrigerant charge. Any other low pressure trips would be due to a fault in the unit.

B. High Pressure Control

The high pressure safety control monitors the compressor discharge pressure and will shut the compressor down if the condensing pressure becomes too high.

There are (3) main reasons why this control would activate in response to the operating conditions of the unit while operating in heating mode:

1. Low or no airflow (or water flow).
2. High return air temperature (or water temperature).
3. Dirty air coil due to poor filter maintenance.

Each of the controls are auto-reset controls. There is also a manual reset high pressure control should the control board be faulty and fail to disengage the compressor. It can be reset by pressing the rubber button on the end of it. It is electrically located between the Y output of the control board and the compressor contactor coil.

The control board (see next section) monitors the pressure controls and shuts the compressor off immediately for a set period of time (adjustable) should there be a fault. The counter for the safety control in question will be increased by 1. The LED indicator for the control will flash until the control is reset as the

pressures equalize in the unit. The unit may restart after the timer period has expired. Should the unit trip on the safety control again, the compressor will once again shut down and the counter will be incremented by one again. Each time this occurs the count is incremented until the counter reaches the max value (default is 3) at which point a permanent lockout will occur if this occurred within a set period of time (default 6 hours) and the compressor cannot be started again until the control board is reset by shorting the reset pins together or turning the power off and on again. The lockout count is decreased after a set period of time (default 6 hours) if there are no more occurrences.

If the control board enters permanent lockout mode there is a serious problem with the system and it must be rectified if the unit is to maintain good service.

DOMESTIC HOT WATER CONNECTIONS



A typical piping diagram for a pre-heat tank configuration can be found in **drawing 000484PDG** at the end of this section. Be sure to note the position of the check valve and the direction of water flow. Other configurations are possible, and there may be multiple units tied together in larger buildings.

WARNING: USE ONLY COPPER LINES TO CONNECT THE DESUPERHEATER. TEMPERATURES COULD REACH 200F SHOULD THE DHW CUTOFF SWITCH FAIL, POTENTIALLY RUPTURING PEX PIPING.



Ensure the tank is filled with water and under pressure before activating the heat pump. Slightly loosen the boiler drain on the DHW Out pipe to allow air to escape from the system before the unit is started. This step will make certain that the domestic hot water circulator in the unit is flooded with water when it is started.

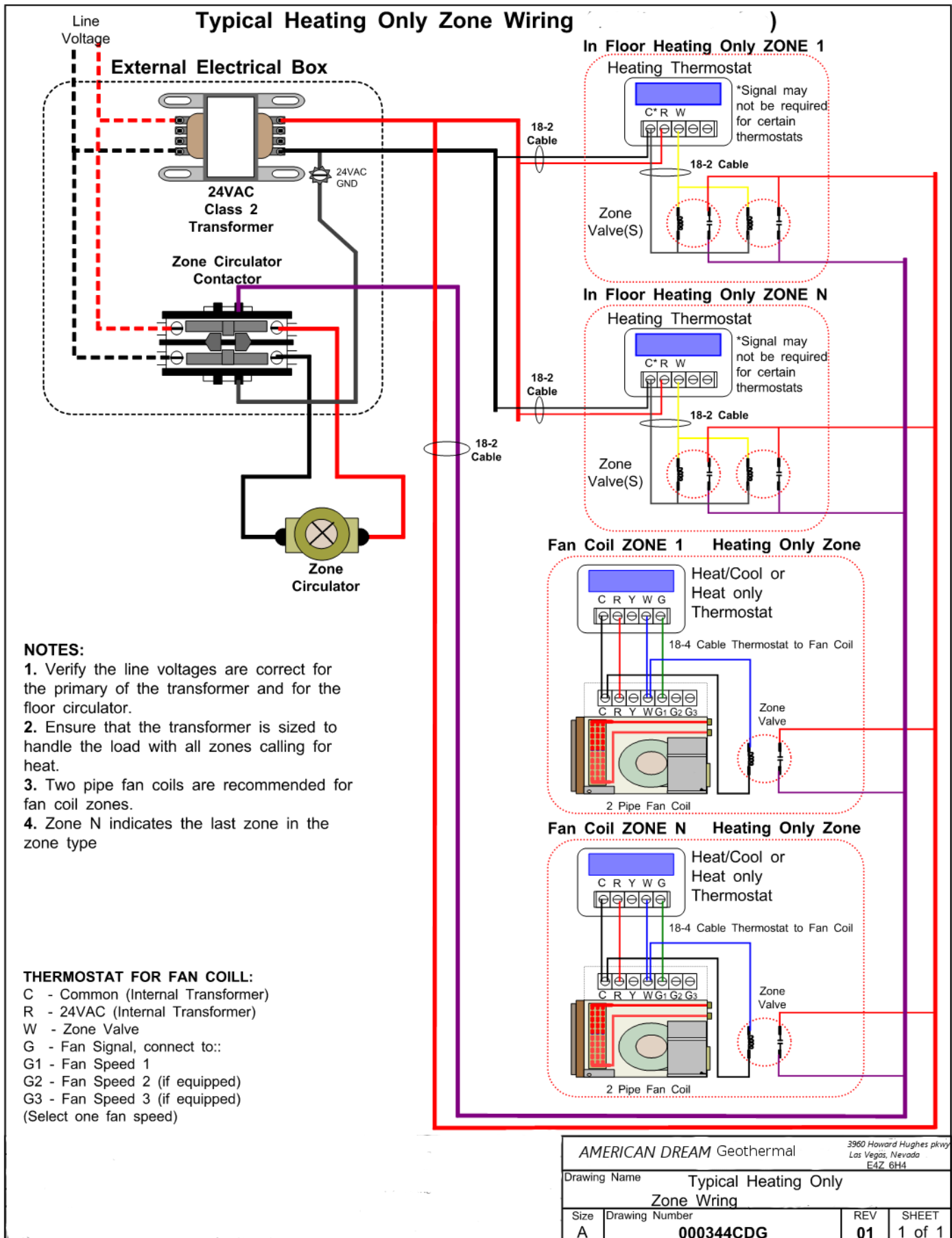
CAUTION: the domestic hot water pump is water lubricated; damage will occur to the pump if it is run dry for even a short period of time.

Connect the brown wire with the blue insulated terminal to L1 of the compressor contactor. **Ensure the power is off when connecting the wire.**

The DHW loop may have to be purged of air several times before good circulation is obtained. A temperature difference between the DHW In and DHW Out can be felt by hand when the circulator pump is operating properly.

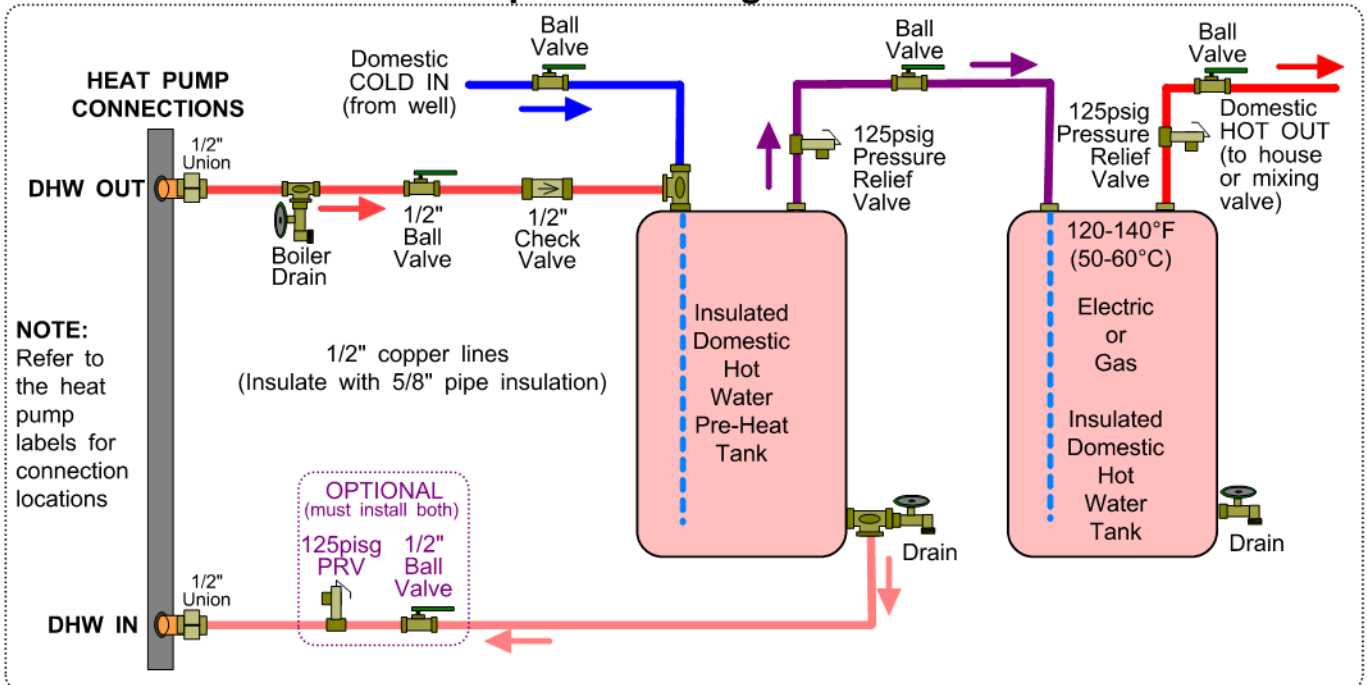
For the pre-heat tank setup, the final tank should be set to **140°F(60°C)**, unless local code requires a higher setting. The pre-heat tank does not require electric elements. This setup takes full advantage of the desuperheater as it is the sole heat provider to the pre-heat tank. The desuperheater remains active during the compressor runtime until the pre-heat tank has been completely heated by the desuperheater alone. This setup is more energy efficient than a single tank setup.

CAUTION: If two (2) shut-off valves are located on the domestic hot water lines as shown in the diagram, a pressure relief valve must be installed to prevent possible damage to the domestic hot water circulator pump should both valves be closed.

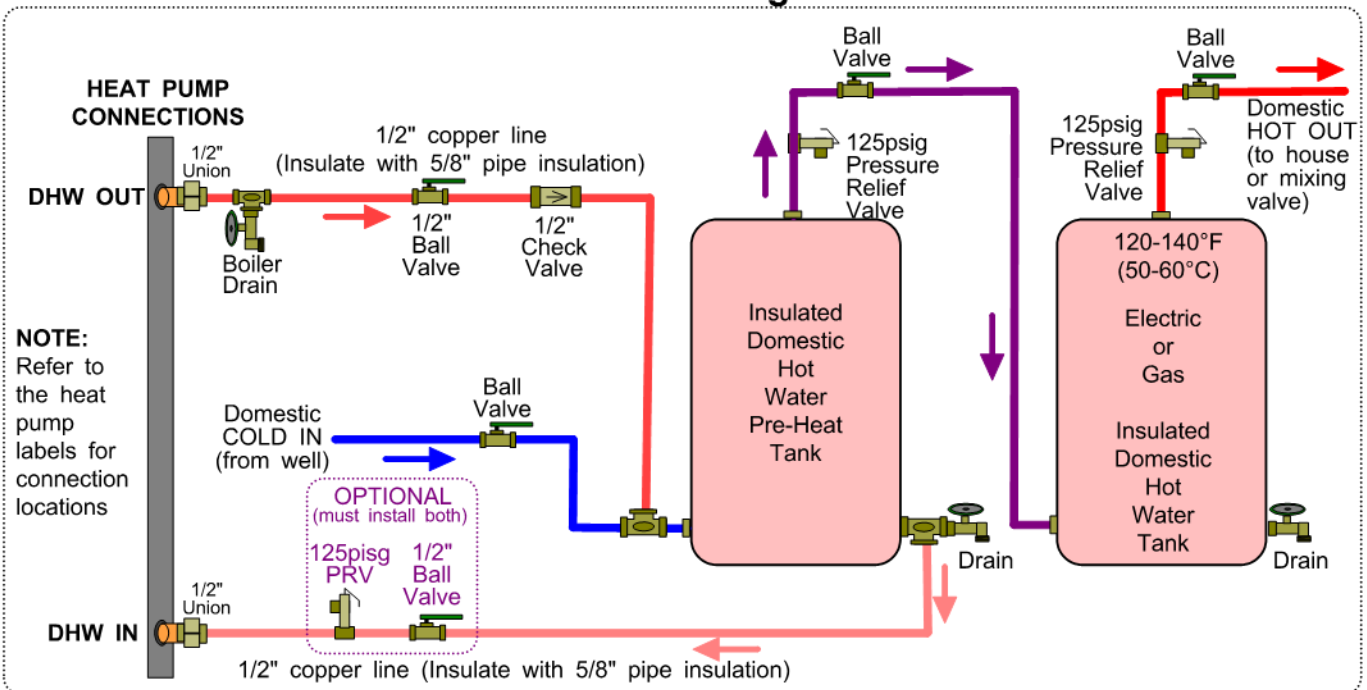


Single Unit Connection to Domestic Hot Water Pre-Heat Tank

Top Port Configuration



Side Port Configuration



					Drawn By Chris Geddes	Date 11 JUN 07	AMERICAN DREAM Ultra Performance 3960 Howard Hughes pkwy Las Vegas, Nevada 89169 E4Z 6H4			
					Checked By Chris Geddes	Date 11 JUN 07	Drawing Name			
					Approved By (ENG) Chris Geddes	Date 11 JUN 07	Single Unit Connection to DHW Pre-Heat Tank			
					Approved By (MFG)	Date	Size	Drawing Number	REV	SHEET
01	Initial Release	C. GEDDES	C. GEDDES	11 JUN 07	Approved By	Date	A	000484PDG	01	1 of 1
REV	ECO #	IMPL BY	APVD BY	DATE						

AMERICAN DREAM Geothermal Unit Operation

REFRIGERATION

Freon Copper operation is essentially the same as any other heat pump. The main difference is in the outdoor loop section. Freon Copper heat pumps eliminate the intermediate ground loop exchanger and pumping equipment by using copper loops to interact directly with the earth. For each ton of capacity, the evaporator (heating mode) consists of one three-way valve, one heating thermostatic expansion valve (TXV), a pair of check valves and one outdoor copper loop with one vapour and one liquid connection to the heat pump. For each additional ton of capacity, there is a parallel evaporator circuit added to the unit.

In heating mode, all loops are used simultaneously to create a large evaporator. This allows maximum heat transfer from the loop field. Since each loop has its own TXV, its superheat can be individually tailored, allowing each loop to obtain the same superheat even if it may have different soil conditions. The loop select valves default to open in heating mode, and as such none of the loop select valve solenoid coils are energized.

In cooling mode, running all loops at the same time would create far too large a condenser and the unit would have very low head pressure, causing the suction pressure to fall off until the low pressure safety control was reached. To circumvent this problem, the direct expansion unit will begin cooling mode by using only Loop 1.

Loops are selected by activating the solenoid on the loop select valve for the loop in question. The remaining loops are scavenged to the suction line.

Using one loop greatly reduces the size of the condenser, allowing the unit to operate properly. As the ground temperature warms up, rejecting the heat to the ground becomes more difficult, causing the head pressure to increase. When the loop is sufficiently hot enough to reach the **Loop Switch set point (480psig)**, the unit will switch to Loop 2. This starts the cycle over with a new loop and allows the previous loop time to recover. Heat pump operation will continue, switching through the loops as required.

The time between loop changes is monitored and should it fall below the adjustable threshold (default 15 minutes), indicating that the loops are sufficiently hot, the heat pump will begin using two loops at a time, and continue cycling. If the loop switch time falls below the threshold on two loop mode, the soaker hose will be turned on (if installed). The soaker hose cools the loops down with water. The loop sequences are shown in **TABLE 7**.

TABLE 7 - Cooling Mode Loop Sequences						
# of Loops	1	2	3	4	5	6
2	1 & 2					
3	1 & 2	2 & 3	1 & 3			
4	1 & 2	3 & 4				
5	1 & 2	3 & 4	1 & 5	2 & 3	1 & 3	4 & 5

As the transition from summer to fall begins and the cooling load is greatly reduced, the loops begin to cool down on their own. Eventually a point is reached at which the loops are cooled down enough that two loops become too large a condenser. This may occur naturally or there may be a few heating days and then a warm spell again (the loops settings are not affected by a switch to heating mode). Two loop operation can no longer be sustained and the unit will trip the low pressure safety control. This occurrence will set the heat pump back to one loop mode and allow the unit to run properly when it automatically restarts after the lockout timer expires.

CONTROL BOARD

All heating / cooling units contain a control board that monitors the thermostat signals, safety controls and loop pressures. It controls the operation of the compressor, fan and auxiliary / emergency heat. It also activates the reversing valve and controls the loop sequencing when in cooling mode. Heating only units do not have a control board.

The number of cooling loops must be configured (done at the factory). There are two jumpers to the top right of the microcontroller. The configuration is shown in **TABLE 8**.

There is also a jumper marked DEFAULT that should be left in place. The jumper marked IF NO B TERMINAL should be left in place as well unless the thermostat used has a B terminal that is constantly powered in heating mode.

TABLE 8 - Cooling Loop Configuration		
# of Loops	Left Jumper	Right Jumper
2	OFF	OFF
3	ON	OFF
4	OFF	ON
5	ON	ON

The control board has 4 connectors: one for the thermostat connections; one for the heat pump component connections; one for the loop solenoid connections; and one for the safety control and loop pressure switch connections. There are also several LEDs to indicate the status of the control board. **Refer to drawing 000301CDG** for the location of the connectors and LEDs.

The Heart Beat LED flashes once every second. This indicates that the control board is operational. An on-board COP watchdog timer resets the microprocessor should anything affect code execution.

The high and low pressure control LEDs flash once per second when a control is open. They will stay on if there is a permanent lockout.

The loop switch LED will come on when the loop pressure switch is activated. Note that the loop switch is only for cooling mode, it does not affect heating mode operation.

There is a compressor short-cycle timer (default 2 minutes) and also a mode switch timer (default 5 minutes). Both are adjustable through the control board communications port.

The high pressure, low pressure and loop switch are 5VDC signals. The low pressure control connects to L and L on the control board. The high pressure control connects to H and H. The loop switch connects to S and S. All other inputs and outputs are 24VAC.

When the thermostat calls for heat, the compressor will start (Stage 1), as will the fan after a short delay (adjustable). The unit will run until the thermostat is satisfied and the unit shuts off (the fan will continue to run for an adjustable period); or, a set period of time elapses (default 40 minutes). Should the set period elapse, the auxiliary heat (Stage 2) will be engaged to help the unit on cold days when the load is too large for the unit.

When the thermostat calls for cooling, the compressor will start (Stage 1), as will the fan after a short delay (adjustable). The unit will run until the thermostat is satisfied and the unit shuts off (the fan will continue to run for an adjustable period). During operation, the control board will cycle through the loops as required.

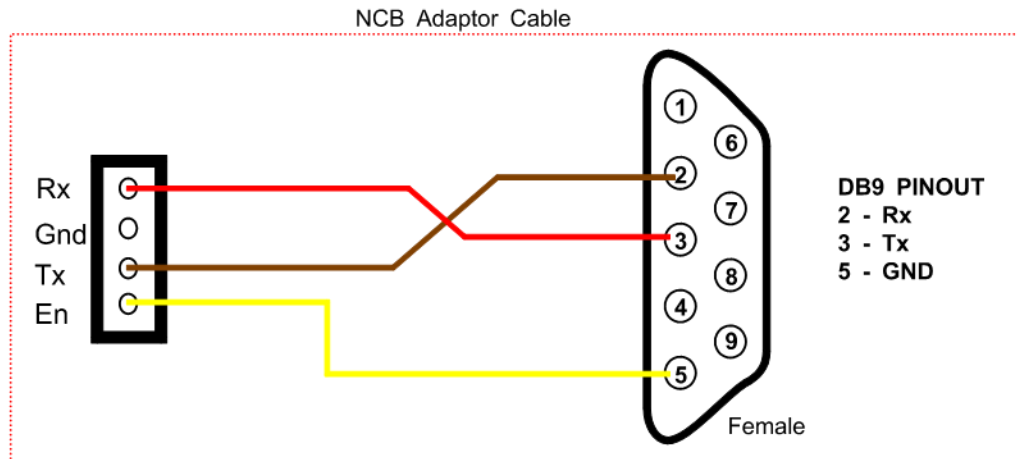
The control board has an RS-232 communications port on board. A simple program such as Hyper Terminal and an adapter cable can be used to communicate with the control board. **Drawing 000301CDG** shows how to build the communications cable. The port settings are shown in **TABLE 9**. The commands available are listed in **TABLE 10**. Note that the COP must be unlocked by command U before using command C to change system settings. The list of settings for command C is shown in **TABLE 11**. It is recommended that the settings be left at the defaults values.

TABLE 9 - RS232 Port Configuration	
Item	Setting
Baud	9600
Data Bits	8
Parity	None
Stop Bits	1
Flow Control	Xon / Xoff

TABLE 11 - Control Board Default Settings	
Command	Air Unit
Blower wait time after comp. start	2sec
Blower run time after comp. stops	5sec
Blower run time after aux. heat off	59sec
Aux. heat on time after comp. on	40min
Comp. off if low lockout (HEAT)	5min
Comp. off if low lockout (COOL)	30min
Comp. off if high lockout (HEAT)	5min
Comp. off if high lockout (COOL)	30min
Comp. off time between heat & cool	5min
Comp. delay since being off	2min
Min. loop time before mode increase	15min
Loop pressure testing wait time	7sec
Soaker start after comp. on time	2hrs
Soaker hose run time (maintenance)	4hrs
Soaker hose run time (emergency)	12hrs
System check interval	2sec
Low pres. lockout counter reduce time	6hrs
High pres. lockout counter reduce time	6hrs
Low pres. lock ignore counter	3 times
High pres. lock ignore counter	3 times
Reset mode = 1 and loop memory time	2 weeks
Maximum mode to be allowed	2
Ignore low pres. for	5min
Ignore low pres. for	0sec

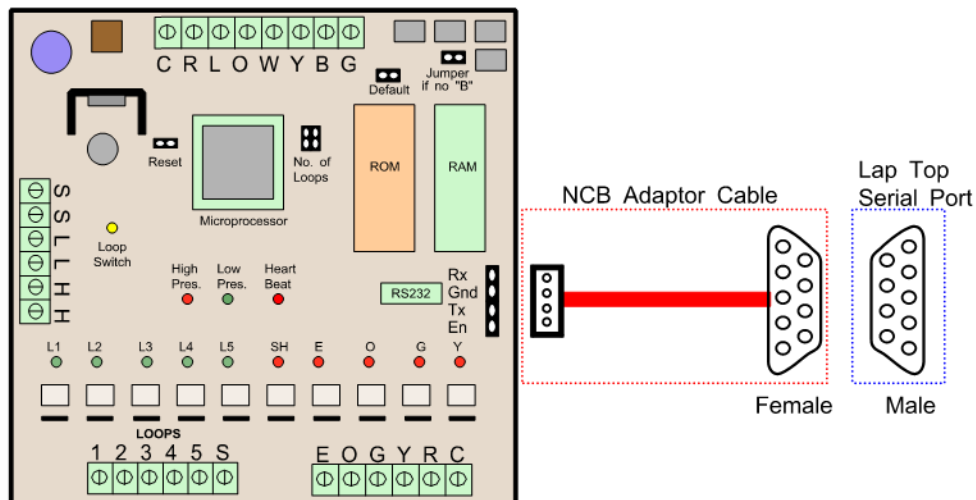
TABLE 10 - Control Board Commands	
Command	Description
H	Help - displays the list of commands
U	Lock / unlock the COP watchdog
L	Display loop status
M	Display loop history
S	Display system status
D	Display system configuration
C	Change system settings (use U first)
T	System runtimes
!	Advance system time by 59 minutes
Z	Reset loop timers to zero

NCB Lap Top Communication Cable



Take a 9-pin serial cable and cut the male end off. A 0.100" spacing 4 pin header can be obtained from a floppy drive power cable in an old computer. Connect the wires as shown in the diagram above. A multimeter set to continuity may be used to find the correct wires from the 9-pin cable. A small paper clip will fit in the 9-pin connector holes.

Hyperterminal can be used to communicate with the control board. The com ports settings are 9600 baud, 8 data bits, no parity, 1 stop bit, Xon/Xoff control. The board echos commands so echo is not required in hyperterminal. Once connected, press H to display the available commands for the control board.



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					Checked By Chris Geddes	Date 19 OCT 06					
					Approved By Chris Geddes	(ENG) Date 19 OCT 06	Drawing Name NCB Lap Top Communication Cable				
					Approved By (MFG)	Date					
01	Initial Release	C. GEDDES	C. GEDDES	19 OCT 06			Size A	Drawing Number 000301CDG	REV 01	SHEET 1 of 1	
REV	ECO #	IMPL BY	APVD BY	DATE	Approved By	Date					

Sizing and Ductwork

HEAT PUMP SIZING

TABLE 12 depicts averages *WILL VARY WITH ENVELOPE EFFICIENCY* as a rough guideline to the size of home each heat pump size can handle.

TABLE 12 - Heat Pump Size vs. Heated Area		
Size (tons)	Sq.ft.	Sq.m.
2	1,000	100
3	1,400	130
4	2,000	185
5	2,600	240

THE TABLE ABOVE IS FOR INFORMATION ONLY, IT SHOULD NOT BE USED TO SELECT A UNIT SIZE. It simply shows on average what size unit is required for a typical two-level home (main level and below grade basement) with R-20 walls, R-40 ceiling and average size and number of windows. The Heated Area is the area of the main level, The tables account for a basement the same size as the heated area.

AMERICAN DREAM Geothermal HIGHLY RECOMMENDS THAT A PROPER HEAT LOSS/GAIN ANALYSIS BE PERFORMED BY A PROFESSIONAL INSTALLER WITH CSA APPROVED SOFTWARE BEFORE SELECTING THE SIZE OF UNIT REQUIRED FOR THE APPLICATION. For heating dominant areas, we recommend sizing the unit to 100% of the heating design load for maximum long term efficiency with minimal supplementary heat. The unit should be installed as per CSA 448.2-02.

There are many factors to consider when sizing the heat pump. Some of these factors include the number of levels, the size of the windows, the orientation of the home, attached garage, bonus rooms, walk-in basement, coldest outdoor temperature, etc. The heat loss program will take all of these factors into consideration in its calculations. An undersized installation will not be as efficient and will require expensive supplementary heat to maintain a comfortable temperature in the home, and the cost savings of having a geothermal heat pump are greatly reduced.

Once the total heat loss has been calculated, the unit can be sized using the performance tables (from the specifications document) in conjunction with the minimum expected entering liquid temperature of the ground loop (well water temperature for ground water system). The heat pump output must be able to match the total heat loss at the selected entering water temperature in order to provide a comfortable environment with minimal auxiliary heat.

DUCT SYSTEMS - GENERAL

Ductwork layout for an AMERICAN DREAM heat pump will differ from traditional hot air furnace design in the number of leads and size of main trunks required. Air temperature leaving the heat pump is normally **95° -105°F (35-40°C)**, much cooler than that of a conventional warm air furnace. To compensate for this, larger volumes of lower temperature air must be moved and consequently duct sizing must be able to accommodate the greater air flow without creating a high static pressure or high velocity at the floor diffusers.

A duct system capable of supplying the required air flow is of utmost importance. AMERICAN DREAM Geothermal recommends that the static pressure be kept below 0.2 inches of water total. In some instances the number of floor diffusers will actually double when compared to the number that would be used for a hot air oil-fired furnace. Refer to **TABLE 15** at the end of this section.

1. Generally allow **100 cfm** for each floor grill.
2. All leads to the grills should be 6" in diameter (28sq.in. each).
3. The main hot air trunks should be at least 75% of the square surface area of leads being fed at any given point.
4. Return air grills should have a minimum of the same total square surface area as the total of the supply grills.
5. The square surface area of the return trunks should equal the square surface area of the grills being handled at any given point along the trunk.

It is **VERY IMPORTANT** that all turns in both the supply trunks and the return trunks be made with **TURNING RADII**. Air act like a fluid and, just like water, pressure drop is increased when air is forced to change direction rapidly around a sharp or irregular corner.

It is recommended that flexible collars be used to connect the main trunks to the heat pump. This helps prevent any vibrations from travelling down the ductwork. If a plenum heater is installed, the collar should be at least 12" away from the heater elements.

The first 5-10 feet of the main supply trunks should be insulated with acoustical duct insulation to further inhibit any noise from the unit from travelling down the ductwork. If a plenum heater is installed, insulation should not be placed within 12" of the heater elements.

Drawing 000606CDG shows a typical installation.

DUCT SYSTEMS - GRILL LAYOUT

Most forced air heating systems in homes have the floor grills placed around the perimeter of the room to be heated. Supply grills should be placed under a window when possible to help prevent condensation on the window. As mentioned in the previous sub-section, supply grill leads should be 6" in diameter (28 sq.in. each) to allow **100cfm** of air flow.

In a typical new construction, there should be one supply grill for every 100sq.ft. of area in the room. When rooms require more than one grill, they should be placed in a manner that promotes even heat distribution, such as one at each end of the room. It is always a good idea to place a damper in each grill supply or place adjustable grills so that any imbalances in the heat distribution can be corrected.

TABLE 13 - Heat Pump Size vs. Hot Air Grills	
Size (tons)	# of Grills (@100cfm)
2	11
3	14
4	17
5	21

The total number of supply grills available is based on the heat pump nominal airflow. **TABLE 13** shows the number of grills available per heat pump size.

Return grills should be mounted on the floor. At minimum they should be the same size as the supply grill, **it is highly recommended that they be 25% to 50% larger than the total supply.** They should be placed opposite the supply grills when possible to ensure distribution across the room. For rooms requiring more than one supply grill, it may be possible to use one larger return grill if it can be centrally positioned opposite of the supply grills, however it is preferred to have one return for each supply to maximize heat distribution across the room.

THERMOSTAT LOCATION

Most homes are a single zone with one thermostat. The thermostat should be centrally located within the home, typically on the main floor. It should be placed away from any supply grills, and should not be positioned directly above a return grill. Most installations have the thermostat located in a hallway, or in the inner wall of the living room. It should be noted that most homes do not have any supply ducts in the hallway. This can lead to a temperature lag at the thermostat if there is very little air movement in the hallway, causing the home to be warmer than indicated by the thermostat.

PLENUM HEATER (OPTIONAL)

For installations that do not already have a backup heat source such as electric baseboard, wood stove, propane etc, it is recommended that a plenum heater be installed. This provides two functions.

The first function of the plenum heater is to act as an auxiliary heat source. As such it will provide additional heat on extremely cold days if the heat pump is unable to bring the home temperature up quickly enough, eliminating any discomfort to the homeowner.

The second function of the plenum heater is to provide emergency heat should a problem occur that causes the heat pump to be locked out. This can be engaged by setting the thermostat to emergency heat, allowing the plenum heater to function while preventing the heat pump from operating. Should the heat pump fail while the home is vacant, the auxiliary function of the thermostat will maintain the temperature setting of the thermostat.

The plenum heater is powered separately from the heat pump. Only two control wires are needed to connect the plenum heater to the heat pump. Refer to the label on the plenum heater or the electrical box diagram on the inside of the electrical box cover of the unit for details on the connections.

The plenum heater should be mounted in the supply duct in a manner that allows all of the airflow to pass through it to prevent any hot spots in the heater elements.

TABLE 14 shows the recommended size plenum heater, as well as the wire size and breaker size needed to provide power to the plenum heater.

CONDENSATE DRAIN

The unit comes equipped with a 3/4" PVC socket fitting (female) labeled "Condensate Drain". This drain allows the condensate which forms during the air-conditioning cycle to be removed from the unit. The drain should be connected as per local codes. During high humidity weather, there could be as much as 25 gallons of water formed per day.

Care should be taken in the spring to ensure that this pipe is not plugged with dust that has collected during the winter causing the condensate to overflow into the bottom of the heat pump and onto the floor. **The condensate drain is internally trapped; however, proper venting is required external to the heat pump. Refer to local codes to ensure the installation is done properly.** **Drawing 000606CDG** shows a typical installation.

HYDRONIC SYSTEMS - GENERAL

The most common applications for the hydronic heating are: (see **drawing 000530PDG** for typical zone types)

- radiant in-floor heating
- On-demand domestic hot water
- Swimming pool or spa

The radiant in-floor areas of the home may be sectioned into several areas called zones. Each zone has its own thermostat, allowing simple separate temperature control of the individual areas in the home. A typical system consists of the heat pump, the buffer tank and the zones. The sole purpose of the heat pump is to maintain the buffer tank set point. Its operation is independent of the zone operation.

HYDRONIC SYSTEM CONNECTIONS

The unit has 1" copper pipe connections for the hydronic system, labeled INDOOR IN and INDOOR OUT. Flow through the unit is provided by an external circulator powered by the control box.

NOTE: Depending on how the system is connected, an external water valve may be required in the INDOOR OUT line to prevent draw through the water coil while in air heating mode. The 24VAC coil of the water valve can be connected across Y1A and CA in the heat pump.

Drawing 000533PDG shows a typical piping configuration for a single unit with a buffer tank. This is a guideline for a simple installation. There are many other configurations, such as, multiple units connected to one buffer tank, on-demand domestic only, etc... It is recommended that the hydronic system be designed by a qualified system designer to ensure proper functionality.

Drawing 000627PDG shows two typical on-demand domestic hot water systems, dedicated and zoned. For a dedicated setup, there are no zones and the home is heated solely by air. The unit can very easily be switched between air or hydronic priority during installation.

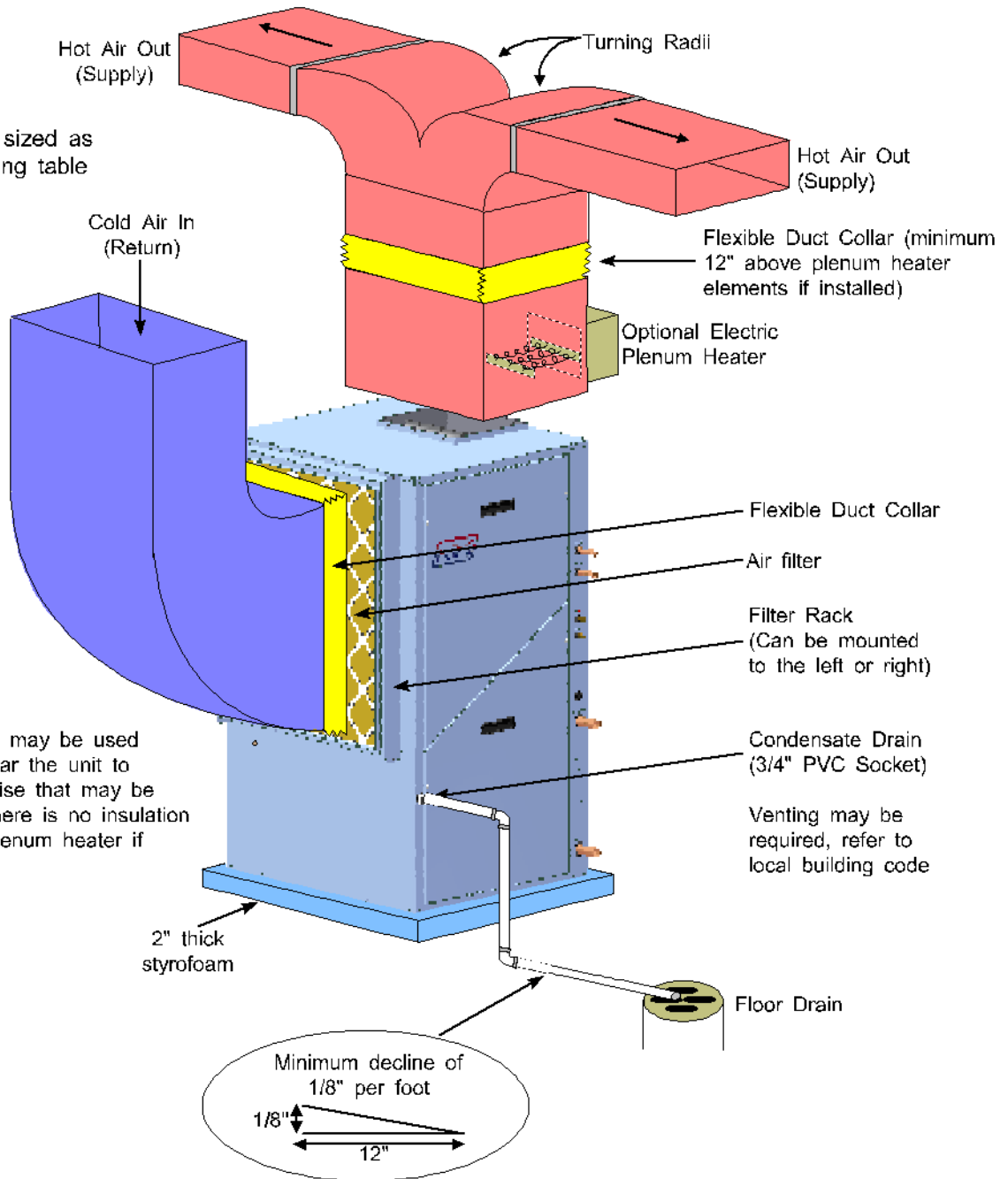
TABLE 14 - Plenum Heater Sizing

Heat Pump	Plenum Heater (230-1-60)			
Size (Tons)	Size (kW)	Current (A)	Breaker (A)	Wire Size
2	6	28	40	#6
3	10	42	60	#6
4	15	62	100	#3
5	20	84	125	#3

Typical Duct and Condensate Connections (Vertical Case)

Ducts should be sized as per the Duct Sizing table in this manual

Acoustic insulation may be used inside the ducts near the unit to dampen any air noise that may be present. Ensure there is no insulation within 12" of the plenum heater if installed.

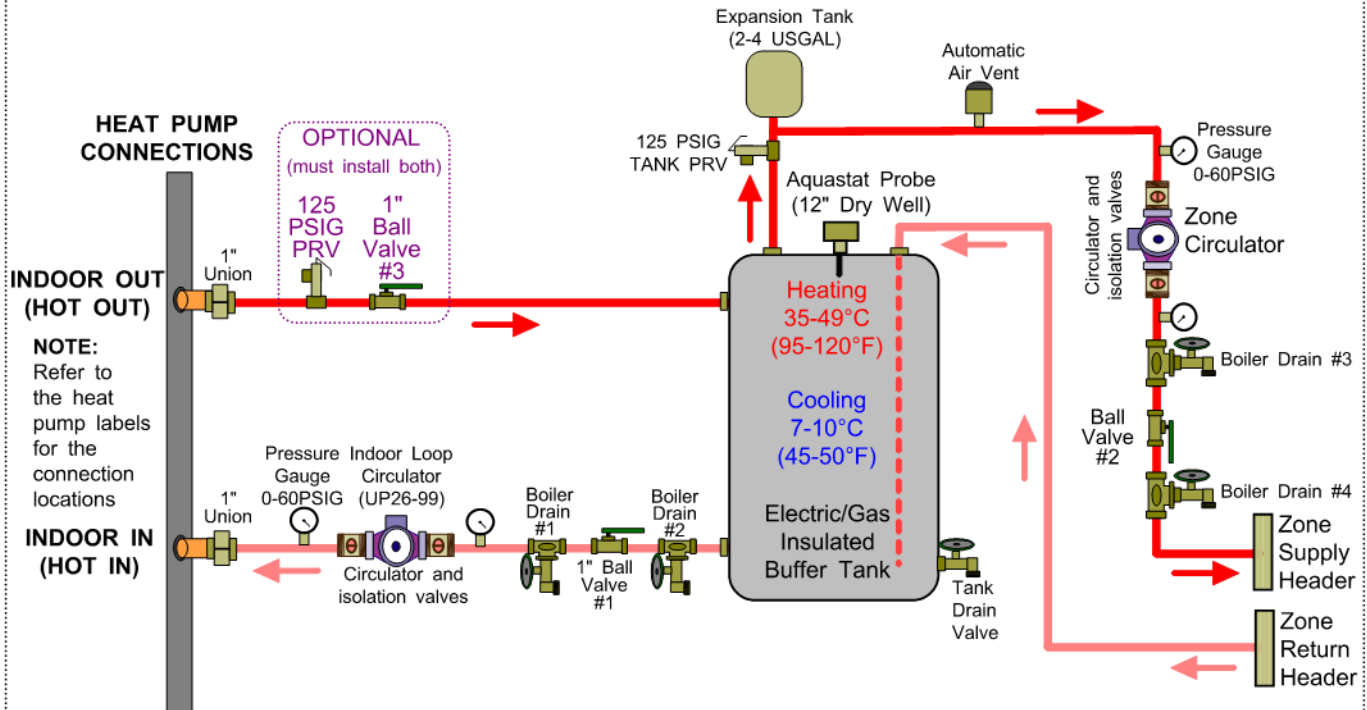


					Drawn By Chris Geddes	Date 15 JAN 08	AMERICAN DREAM Geothermal 3960 Howard Hughes pkwy Las Vegas, Nevada E42 8H1				
					Checked By Chris Geddes	Date 15 JAN 08					
					Approved By (FNG) Chris Geddes	Date 15 JAN 08	Drawing Name Typical Duct and Condensate Connections (Vertical Case)				
					Approved By (MFG)	Date					
01	Initial Release	C. GEDDES	C. GEDDES	15 JAN 08	Approved By		Date	Size A	Drawing Number 000606CDG	REV 01	SHEET 1 of 1
REV	ECO #	IMPL BY	APVD BY	DATE	Approved By		Date				

TABLE 15 - Duct Sizing Guide (external static of 0.20"H2O)

Airflow (CFM)	Minimum Duct Area (sq.in)	Diameter (in)	Rectangular Equivalents (in)						Return Air Diameter (in)	Airflow (L/s)
37	20	5	2.25 x 10	3 x 8	3.5 x 6	4 x 5.5	5 x 5		← 5	17
63	20	5	2.25 x 10	3 x 8	3.5 x 6	4 x 5.5	5 x 5		↗ 6	30
100	28	6	3.25 x 10	4 x 8	5 x 6	5.5 x 5.5	6 x 6		← ↗ 7	47
152	38	7	3.25 x 14	4 x 11	5 x 8.5	6 x 7	6.5 x 6.5		← ↗ 8	72
212	50	8	4 x 15	5 x 12	6 x 10	7 x 8	8 x 8		← ↗ 9	100
226	50	8	4 x 15	5 x 12	6 x 10	7 x 8	8 x 8		↗ 10	107
277	64	9	5 x 15	6 x 12	7 x 10	8 x 9	8.5 x 8.5		← ↗ 10	131
304	64	9	5 x 15	6 x 12	7 x 10	8 x 9	8.5 x 8.5		↗ 12	143
393	79	10	6 x 15	7 x 13	8 x 11	9 x 10	9.5 x 9.5		← ↗ 12	185
411	113	12	7 x 18	8 x 16	9 x 14	10 x 12	11 x 11		← ↗ 12	194
655	113	12	7 x 18	8 x 16	9 x 14	10 x 12	11 x 11		↗ 14	309
680	154	14	8 x 22	9 x 19	10 x 17	11 x 15	12 x 14	13 x 13	← ↗ 14	321
995	154	14	8 x 22	9 x 19	10 x 17	11 x 15	12 x 14	13 x 13	↗ 16	470
1325	201	16	8 x 30	10 x 22	12 x 18	14 x 16	15 x 15		← ↗ 18	625
1450	201	16	8 x 30	10 x 22	12 x 18	14 x 16	15 x 15		↗ 20	684
1750	254	18	8 x 40	10 x 30	12 x 24	14 x 20	16 x 17	16.5 x 16.5	← ↗ 20	826
2000	254	18	8 x 40	10 x 30	12 x 24	14 x 20	16 x 17	16.5 x 16.5	↗ 22	944
2250	314	20	10 x 38	12 x 30	14 x 26	16 x 22	18 x 19	18.5 x 18.5	← ↗ 22	1062
2600	314	20	10 x 38	12 x 30	14 x 26	16 x 22	18 x 19	18.5 x 18.5	↗ 24	1227
2900	380	22	12 x 36	14 x 30	16 x 26	18 x 23	20 x 20		← ↗ 24	1369
3400	380	22	12 x 36	14 x 30	16 x 26	18 x 23	20 x 20		↗ 26	1605
3600	452	24	14 x 38	16 x 32	18 x 28	20 x 25	22 x 22		← ↗ 26	1699
4300	452	24	14 x 38	16 x 32	18 x 28	20 x 25	22 x 22		↗ 28	2029
5250	531	26	16 x 38	18 x 32	20 x 30	22 x 24	24 x 24		← ↗ 30	2478
6125	616	28	18 x 38	20 x 34	22 x 30	24 x 28	26 x 26		← ↗ 32	2891
6500	616	28	18 x 38	20 x 34	22 x 30	24 x 28	26 x 26		↗ 34	3068
7250	707	30	20 x 40	22 x 38	24 x 32	26 x 30	28 x 28		← ↗ 34	3422
7800	707	30	20 x 40	22 x 38	24 x 32	26 x 30	28 x 28		↗ 36	3681
8500	804	32	22 x 40	24 x 38	26 x 34	28 x 32	30 x 30		← ↗ 36	4012
9200	804	32	22 x 40	24 x 38	26 x 34	28 x 32	30 x 30		↗ 38	4342
9800	908	34	24 x 42	25 x 40	26 x 38	28 x 34	30 x 32	31 x 31	← ↗ 38	4625
10900	908	34	24 x 42	25 x 40	26 x 38	28 x 34	30 x 32	31 x 31	↗ 40	5144
			28 x 40	30 x 36	32 x 34	33 x 33			← ↗	
			30 x 42	32 x 38	34 x 36	35 x 35			← ↗	
			30 x 45	34 x 40	36 x 38	37 x 37			← ↗	

Typical Buffer Tank Configuration - Four Port Tank



NOTES:

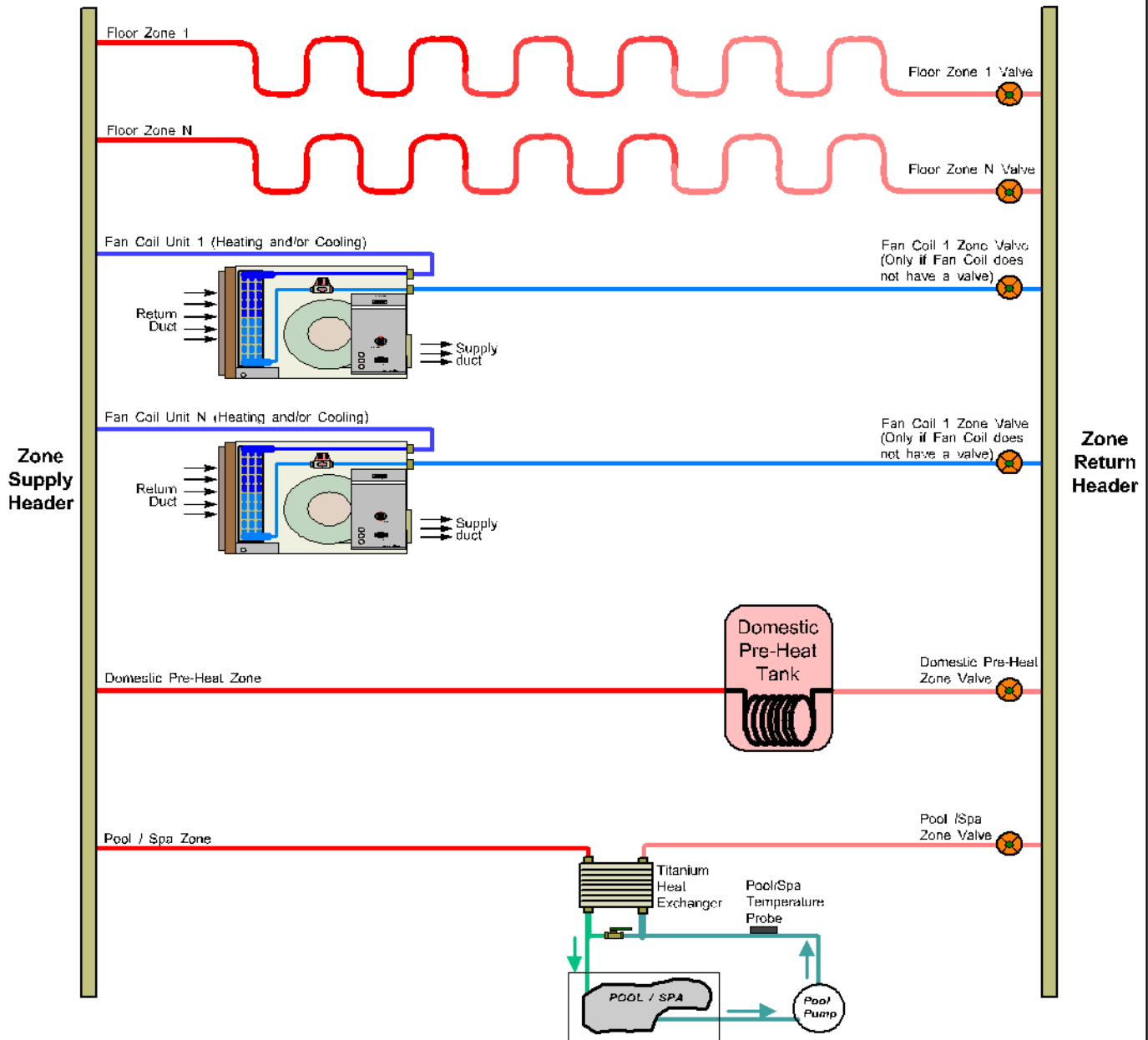
1. Refer to diagram 000530PDG for the typical types of zones that may be connected to the supply and return headers.
2. Unions or another type of disconnect should be used to connect the heat pump to the loop.
3. Circulators should be mounted vertically when possible to reduce the chance of air getting caught in the housing.
4. The automatic air vent must be installed upright to function properly.
5. If the optional 1" ball valve is installed in the Indoor Out line, **the PRV must be installed as well**, to prevent pressure build up should both ball valves be closed.
6. Pressure gauges (0-60PSIG) are placed on both sides of the circulators for a quick check method to determine that the circulators are pumping.
7. Ensure the floor circulator is adequately sized to accommodate the type and number of zones connected to the system.
8. The aquastat probe should be placed all the way in the dry well, and the end of the well where the probe wire is should be well insulated.
9. The loop may be filled with water or an antifreeze mix. If the antifreeze used is flammable (ie methanol), and there are electric elements in the buffer tank, ensure there is a method to prevent the electric elements from turning on if the tank is not completely full. One method is to use a pressure switch to disable the elements should the pressure in the tank drop below a setpoint, such as 5 or 10PSIG. Allowing the elements to come on when they are not fully submerged will burn the element out and **could cause an explosion**.

PURGING PROCEDURE:

1. Ensure the power to the heat pump and any other power supplies connected to the system (floor circulator, etc) are turned off.
2. The system can be filled using Boiler Drain #1.. Connect the fill hose to the boiler drain and begin filling. Open the tank PRV to purge the air out as the system fills. Close the tank PRV when water begins to run out of it.
3. Open the automatic air vent.
4. Connect the purge hose to Boiler Drain #2. Close Ball Valve #1. Open Ball Valve #3 if installed. Open Boiler Drain #2. Purge until air is no longer heard leaving the system. Open the Tank PRV and let any air out. Close Boiler Drain #1, #2 and Ball Valve #1 and #3 if installed.
5. Zone can be purged by moving the fill hose (turn it off first) from Boiler Drain #1 to Boiler Drain #4. Connect the purge hose to Boiler Drain #3. Close Ball Valve #2. Open Boiler Drains #3 and #4. Purge each zone individually and then open them all at once. Zones can be opened using the individual thermostats or most can be opened manually. Open the Tank PRV intermittently to purge any air during this process.
6. When purging is complete, pressurize the system between 15 and 25PSIG.
7. Turn the fill hose off. Close Boiler Drains #3 and #4. Open Ball Valve #2. Remove the fill (turn the hose off first) and purge hoses.
8. Repeat steps 4 to 6 as necessary if air is still present in the system.

					Drawn By Chris Geddes	Date 10 SEP 07	3960 Howard Hughes pkwy Las Vegas, Nevada E4Z 6H4			
					Checked By Chris Geddes	Date 10 SEP 07	Drawing Name Typical Buffer Tank Configuration - Four Port Tank			
					Approved By Chris Geddes	Date 10 SEP 07				
					Approved By (MFG)	Date	Size A			
					Approved By	Date				
01	Initial Release	C. GEDDES	C. GEDDES	10 SEP 07				Drawing Number	000533PDG	REV
REV	ECO #	IMPL BY	APVD BY	DATE						01
										1 of 1

Typical Zone Types for Hydronic Applications



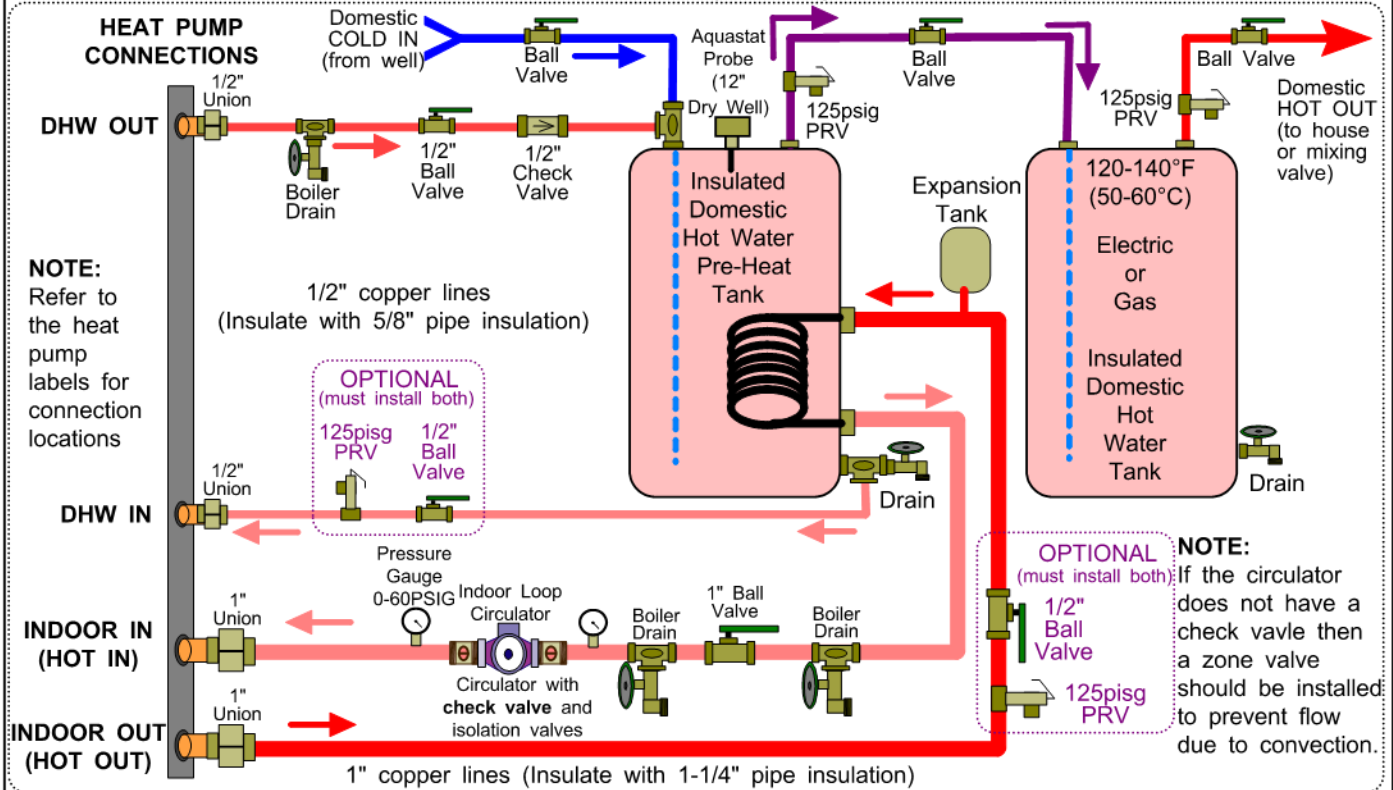
NOTES:

1. Floor zones are heating only. Cooling a floor zone will cause condensation in the floor. Floor zone valves should be wired through a relay that is controlled by the cooling signal (Q) that breaks the signal when in cooling mode to ensure that they cannot accidentally be energized.
2. There may be multiple floor zones.
3. There may be multiple fan coil units, (heating and /or cooling). A zone valve is not required if the unit has a internal valve.
4. Domestic Pre-Heat Tank is for on-demand applications. The tank must have a heat exchanger in it or an external one must be used to separate the zone loop from the potable water supply.
5. Ensure the floor circulator is adequately sized to accommodate the type and number of zones connected to the system.
6. The pool aquastat will operate the Pool/Spa Zone Valve.

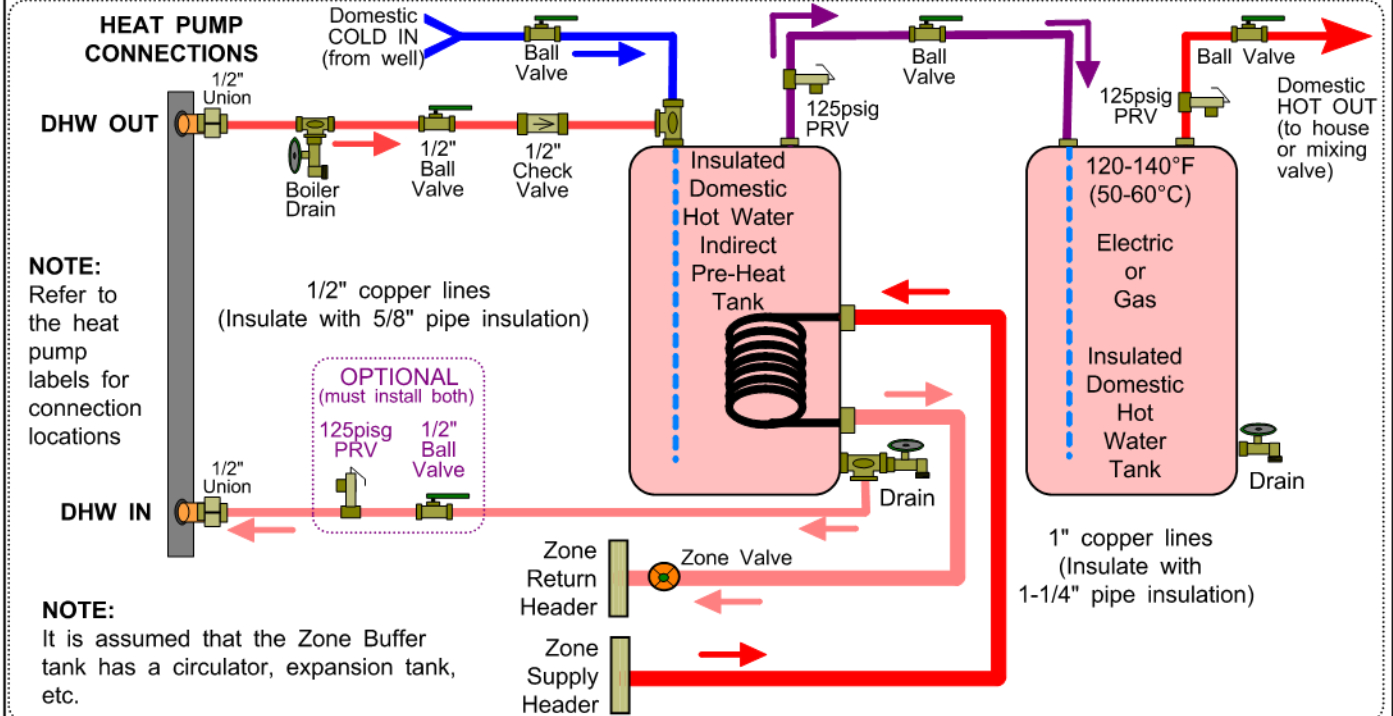
					Drawn By Chris Geddes	Date 06 SEP 07	3960 Howard Hughes Pkwy Las Vegas, Nevada 89164			
					Checked By Chris Geddes	Date 06 SEP 07				
					Approved By (ENG) Chris Geddes	Date 06 SEP 07	Drawing Name			
					Approved By (MFG)	Date	Typical Zone Types for Hydronic Applications			
01	Initial Release	C. GEDDES	C. GEDDES	06 SEP 07	Approved By	Date	Size A	Drawing Number 000530PDG	REV 01	SHEET 1 of 1
REV	ECO #	IMPL BY	APVD BY	DATE	Approved By	Date				

Single Unit Connection to On-Demand Domestic Hot Water Pre-Heat Tank

Dedicated On-Demand System (No other zones)



Zoned On-Demand System



					Drawn By Chris Geddes	Date 15 FEB 08	AMERICAN DREAM Geothermal 3960 Howard Hughes Pkwy Las Vegas, Nevada E4Z 6H4				
					Checked By Chris Geddes	Date 15 FEB 08					
					Approved By Chris Geddes	(ENG) Date 15 FEB 08	Drawing Name Single Unit Connection to On-Demand DHW Pre-Heat Tank				
					Approved By (MFG)	Date					
01	Initial Release	C. GEDDES	C. GEDDES	15 FEB 08	Approved By		Date	Size A	Drawing Number 000627PDG	REV 01	SHEET 1 of 1
REV	ECO #	IMPL BY	APVD BY	DATE	Approved By		Date				

Loop Connection & Charging

LINE SET INTERCONNECT TUBING

Once the outside loops have been installed and run into the building, the piping to the ports on the unit can be constructed. Each line set has a liquid line and a vapour line. The vapour line is 1/2" (OD) and the liquid line is 1/2" (OD). For horizontal loops, both lines are 1/2" (OD), reduce one of the lines in each line set down to 3/8" (OD) before running the lines over to the heat pump. These reduced lines will be the liquid line for each line set.

Do a final pressure check on each line set and then remove the pressure and cut the ends off the lines. The heat pump has ports labeled Liquid 1 to 5 and Vapour 1 to 5. Run each line set over to the designated ports on the heat pump. Refer to **Diagram 000769CDG** for more information on how to connect to the heat pump.

The tubing used for this procedure must be refrigeration tubing (cleaned & dehydrated) suitable for the job. Every effort must also be made to insure that the tubing does not become contaminated during installation. We recommend that caps be placed on the open ends of tubing immediately after cuts are made and that these caps are only removed after all bends have been made and the pipe fixed in its permanent location ready to make the silver soldered joints. It is very important to keep a refrigeration system perfectly clean and dry. Removing the caps just prior to silver soldering will ensure minimum exposure to the humidity in the atmosphere.

PIPE INSULATION

All line set piping inside the structure (between the structure entry point and the heat pump) should be insulated with 3/8" thick closed cell pipe insulation to prevent condensation and dripping onto floors or walls during the heating season. It can be slid onto the capped tubing without having to slice it down the side. Ensure that any joints in the line sets are accessible for leak testing.

Liquid and Vapour ports and any remaining exposed tubing should be insulated with 3/8" thick closed cell pipe insulation once the silver soldering and pressure testing is complete. Ensure that all individual pieces of pipe insulation are glued to each other so there are no air gaps.

SILVER SOLDERING LINE SETS

Once all the line sets have been routed, insulated and fastened in place, the connections to the heat pump ports can be made. Remove the pressure from the heat pump and cut the ends off of the Liquid and Vapour ports. Remove the caps from the line set tubing. The line sets can be connected to the ports on the heat pump using couplings, or alternately the tubing can be "swaged". The joints should be silver soldered with 5% silfos.

AMERICAN DREAM Geothermal absolutely requires that dry nitrogen be bled through the system during all silver soldering procedures so that no oxidation occurs on the inside of the copper tubing. The service ports on the unit can be used to connect the nitrogen with a refrigeration manifold.

If necessary, a damp cloth can be wrapped around the each of the ports to prevent melting the grommet when silver

soldering. Ensure that no water enters any of the ports or tubing.

PRESSURE TESTING

Once all connections are complete, the system should be pressure tested to **100PSIG (690kPa)** with dry nitrogen. Check all joints at the unit and any made in the interconnect tubing for leaks using soap suds, Spray nine, etc. It is important not to bypass this step as vacuuming the system with a leak will be impossible and attempting to do so will introduce moisture into the system, making the vacuum process take much longer than if the leak had been found and repaired first.

VACUUMING THE SYSTEM

Remove the pressure from the system and connect the vacuum pump to the refrigeration manifold. Tighten all hose connections, open the valves on the manifold and start the vacuum pump.

Vacuum the system until the reading on an electronic vacuum gauge remains below 500 microns for a period of 5 minutes after the vacuum pump is shut off and the system sealed.

CHARGING THE SYSTEM

Once the system has been vacuumed, refrigerant can be added by weighing in 1/3 of the prescribed refrigerant charge into the low side of the system. Start the heat pump in the heating mode and continue to add refrigerant as a liquid at a rate of no more than 1 lb. per minute until the prescribed charge is reached.

Alternately, before the machine is started, the entire charge can be weighed into the system through the high side of the system. **TABLE 16** shows the typical charge per unit size. This allows for:

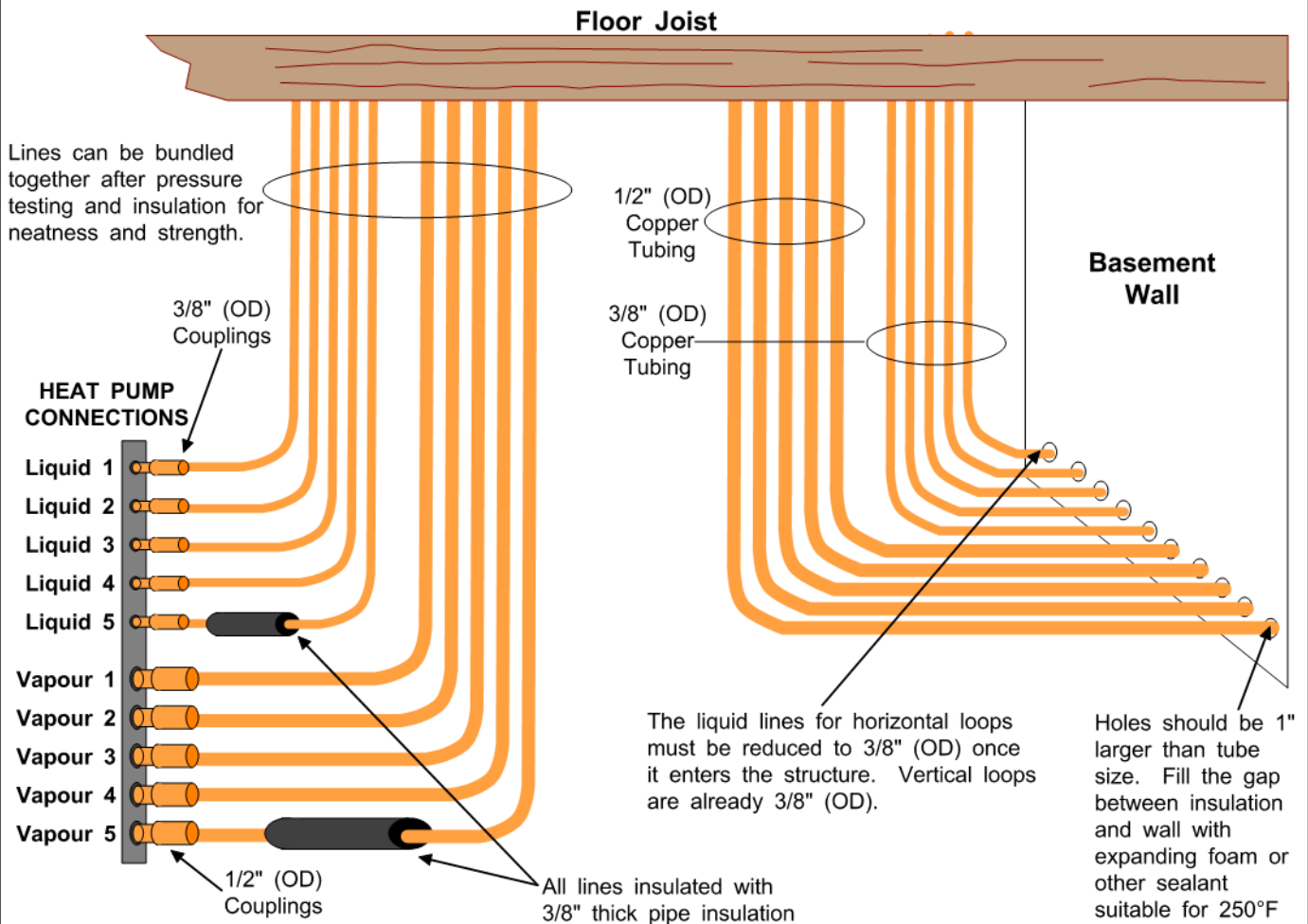
- 20ft of distance (40ft of pipe) interconnect tubing from the unit to the wall,
- 20ft of distance from the wall to the borehole /trench,
- a standard loop (100ft borehole or 150ft trench).

Additional refrigerant is required as per **TABLE 16** if the installation exceeds these parameters.

TABLE 16 - Charge Chart

Model	Size (tons)	Lbs.	kg
45	3	12	5.4
55	4	16	7.3
65	5	20	9.1
Extra loop (borehole)		1	0.5
Extra loop (trench)		1.5	0.7
Extra distance to borehole Extra depth of borehole Extra distance to trench Extra length of trench Extra distance in structure		0.1oz per foot	0.003

FC Line Set Interconnect Tubing Installation (R410a)



NOTES:

- Ensure the line sets are kept in order and routed to the proper ports on the heat pump.
- Holes through the foundation / structure should be filled with expanding foam from both sides to prevent leakage.
- Proper drainage material should be used on the outside of the wall to prevent water buildup.
- All joints should be soldered with 5% silver solder.
- Pressure test to 100PSIG and check for leaks once all connections are complete.
- All lines inside the structure and through the wall should be insulated with 3/8" to 1/2" thick closed cell pipe insulation.
- Ensure adjoining pipe insulation pieces are glued or tapes together to prevent gaps.
- Tubing should be securely fastened to prevent accidental bending.

					Drawn By Chris Geddes	Date 05 AUG 08	AMERICAN DREAM Geothermal 3960 Howard Hughes Pkwy Las Vegas, Nevada E4Z 6H4			
					Checked By Chris Geddes	Date 05 AUG 08				
					Approved By Chris Geddes	(ENG) Date 05 AUG 08	Drawing Name DX Line Set Interconnect Tubing Installation (R410a)			
					Approved By (MFG)	Date				
02	000141	C. GEDDES	C. GEDDES	19 MAY 09			Size	Drawing Number	REV	SHEET
01	Initial Release	C. GEDDES	C. GEDDES	05 AUG 08			A	000769PDG	02	1 of 1
REV	ECO #	IMPL BY	APVD BY	DATE						

Startup Procedure

The following steps describe how to perform the startup procedure of the geothermal heat pump.

The Two-Stage R410a Air and Hydronic Startup Records located in this manual are used in conjunction with this startup procedure to provide a detailed record of the installation. A completed copy should be left on site, a copy kept on file by the installer and a copy should be sent to AMERICAN DREAM Geothermal.

Check the boxes or fill in the data as each step is completed. For data boxes, circle the appropriate units. Fill in the top section of all three copies, or one copy if photocopies can be made after the startup has been completed.

PRE-START INSPECTION

Ductwork:

1. Verify that all ductwork has been completed and is firmly attached to the unit. Verify that any dampers or diverters are properly set for operation of the heat pump.
2. Verify that all registers are open and clear of any objects that would restrict the airflow.
3. Verify that a new air filter is installed and the cover is secured.
4. Verify the condensate drain is connected, properly vented and free of debris.
5. If a plenum heater has been installed, verify that it is securely fastened to the ductwork.

Indoor Loop (Hydronic Loop):

1. Verify that all shutoff valves are fully open and there are no restrictions in the piping from the heat pump to the indoor loop, and that full flow is available to the heat pump.
2. Verify that the entire system has been flooded and all the air has been purged as much as possible. Further purging may be required after the system has been operating for a while.
3. Verify that the loop contains the proper mix of antifreeze (if used) for the intended application. Record the type of antifreeze and the mixture value on the startup sheet, circle % Vol. or % Weight.
4. Record the static loop pressure on the startup sheet.

Line Sets (Inside structure):

1. Verify that all line sets are connected to the proper ports on the heat pump.
2. Verify that the line sets are completely insulated and securely fastened in place.

Domestic Hot Water (if equipped):

1. Verify that all shutoff valves are fully open and there are no restrictions in the piping from the heat pump to the domestic hot water tank.
2. Verify that the entire system has been flooded and all the air has been purged as much as possible. Further purging may be required after the system has been operating for a while.
3. Verify that the brown wire with the insulated terminal is disconnected in the electrical box. Refer to the schematic diagram for more information.

Electrical:

1. **Ensure the power to the unit is off. Ensure the power to the plenum heater is off if equipped.**
2. Verify all high voltage connections. Ensure that there are no stray wire strands, all connections are tight and the ground wire is connected tightly to the ground connector for the heat pump and plenum heater.
3. Record the fuse / circuit breaker size and wire gauge for the heat pump. Record the fuse / circuit breaker size, wire gauge and size of the plenum heater if installed.
4. Verify that the control connections to the thermostat and plenum heater (if installed) are properly connected and all control signals are off, so that the unit will not start up when the power is turned on.
5. Ensure all access panels except the lower one that provides access to the electrical box are in place.

Unit Charge:

1. Ensure the unit has been vacuumed and has refrigerant in it. If the unit is not fully charged, the remainder can be added during the start up procedure. Record the current amount of refrigerant in the system.

UNIT STARTUP (AIR)

The unit is now ready to be started. The steps below outline the procedure for starting the unit and verifying proper operation of the unit. **It is recommended that safety glasses be worn during the following procedures.**



ENSURE UNIT IS CHARGED WITH REFRIGERANT BEFORE TURNING THE POWER ON. STARTING A COMPRESSOR UNDER VACUUM WILL DESTROY IT IN A MATTER OF SECONDS, VOIDING THE WARRANTY. IF THE UNIT IS NOT FULLY CHARGED, THE REMAINDER CAN BE ADDED DURING HEATING MODE STEP 2.



Preparation:

1. Remove the caps from the service ports and connect a refrigeration manifold set to the unit.
2. Turn the power on to the heat pump and set the thermostat to OFF. Set up the thermostat as per the instructions provided with it so that it will function properly with the heat pump system (set for heat pump, not for heating and cooling). The O signal should be set to active in cooling mode.
3. Measure the following voltages on the compressor contactor and record them on the startup sheet: L1-L2, L2-L3, L1-L3.

Air Heating Mode:

1. Set the thermostat to heating mode and adjust the setpoint to activate Stage 2. The fan should slowly ramp up to speed after the time delay of the thermostat expires (if applicable) and the compressor will start.
2. Check the refrigeration gauges. The suction and discharge pressures will depend on the loop temperatures, but they should be about **75-95PSIG** and **290-365PSIG** respectively for a typical start-up. If the unit was not completely charged, add the remaining refrigerant through the suction side only.
3. Monitoring the refrigeration gauges while the unit runs. Record the following data at the time interval(s) indicated: Numbers 1 to 4, record at 10, 15, 20, 25, 30 and then average the values. Record numbers 5 to 8 at 30 minutes. The average superheat for each line set should be **8-14°F (4-8°C)**. The TXV's are set to four turns in (from all the way out) at the factory and typically should not require any adjustments. Should adjustment be required, follow the Heating TXV Adjustment procedure in this manual. Proceed to Step 4 once adjustments have been completed.
 1. Suction pressure
 2. Discharge pressure
 3. Each loop Vapour Line temperature
 4. Each loop superheat (Vapour line temperature - evaporating temperature (from suction gauge))
 5. Duct Return temperature (poke a small hole in the flex collar and insert probe in airstream)
 6. Duct Supply temperature (poke a small hole in the flex collar and insert probe in airstream)
 7. Duct Delta T (should be between **22-32°F, 12-18°C**)
 8. Compressor L1(C) current (black wire, place meter between electrical box and compressor)
4. Adjust the thermostat setpoint to the desired room temperature and let the unit run through a cycle. Record the setpoint and the discharge pressure when the unit shuts off.
5. For units with a desuperheater, turn the power off to the unit. Connect the brown wire with the blue insulated terminal to the compressor contactor as shown in the electrical box diagram. Turn the power to the unit on.
6. Remove the electrical cover from the plenum heater. Place a current clamp meter around one of the supply wires. Turn on the power to the plenum heater. Adjust the thermostat setpoint to **85°F (29°C)**. Verify that the current draw increase as each stage is activated. (10kW has 2 stages, 15kW has 3 stages and 20kW has 4 stages).
7. Verify the DHW IN and DHW OUT temperatures (if applicable) by hand (**caution: pipes get hot**). If the DHW OUT line does not become hotter than the DHW IN line the circulator is air locked. Bleed the air from the system and check the temperature differential again to ensure there is flow from the circulator.

Cooling Mode:

1. Set the thermostat to cooling mode and adjust the setpoint to activate Stage 1 and Stage 2.
2. Monitoring the refrigeration gauges while the unit runs. Record the following after 10 minutes of runtime:
 1. Suction pressure
 2. Discharge pressure
 3. Duct Return temperature
 4. Duct Supply Out temperature
 5. Duct Delta T
3. Adjust the thermostat setpoint to the desired room temperature if possible, otherwise set it just low enough to allow the unit to run (ie 1°F (0.5°C) less than room temperature) and let the unit run through a cycle. Record the thermostat setpoint and the suction pressure when the unit shuts off.

Final Inspection:

1. Turn the power off to the unit (and plenum heater if installed) and remove all test equipment.
2. Install the electrical box cover and the access panel on the heat pump. Install the service port caps securely to prevent refrigerant loss. Install the electrical cover on the plenum heater if applicable.
3. Do a final check around the heat pump and ensure the area is clean.
4. Leave a copy of the Startup Record at the installation site, send a copy to Maritime Geothermal Ltd. and keep the final copy.
5. Turn the power on to the unit and the plenum heater if installed. Set the thermostat to the final settings.

Startup Record (Air)—2-5 Ton Two-Stage R410a

Installation Site		Startup Date	Installer	
City			Company	
Province			Model	
Country			Serial #	

Check boxes unless asked to record data. Circle data units.

PRE-START INSPECTION

Ductwork	Ductwork is completed, dampers/ diverters are adjusted															
	Registers are open and clear of objects															
	Air filter and end cap are installed															
	Condensate Drain is connected, properly vented and free of debris															
	Plenum heater is securely fastened (if applicable)															
Line Sets	Connected to proper ports, insulated and secured in place															
Domestic Hot Water	All shut-off valves are open															
	Lines are full and purged															
	Desuperheater pump wire is disconnected															
Electrical	High voltage connections are correct and securely fastened		<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 10%;">A</td> <td style="width: 10%;"></td> <td style="width: 10%;">Ga.</td> <td style="width: 10%;"></td> <td style="width: 10%;"></td> </tr> <tr> <td>A</td> <td></td> <td>Ga.</td> <td></td> <td>kW</td> </tr> </table>				A		Ga.			A		Ga.		kW
	A						Ga.									
	A						Ga.		kW							
	Circuit breaker (or fuse) size and wire gauge for Heat Pump															
Circuit breaker (or fuse) size, wire gauge, and Plenum Heater size																
Low voltage connections are correct and securely fastened																
Unit Charge	Refrigerant charge before power is turned on		Lbs	kg												

STARTUP DATA

Preparation	Voltage across L1 and L2, L1 and L3, L2 and L3														VAC
	Final refrigerant charge								Lbs	kg					
Heating Mode	Suction	Discharge	V1	S1	V2	S2	V3	S3	V4	S4	V5	S5	V6	S6	
	10 minutes														
	15 minutes													°F	
	20 minutes													°C	
	25 minutes														
	30 minutes														
	Average														
	Duct Return, Duct Supply, and Delta T								In		Out		°F	°C	
	Compressor L1 (black wire) current								A						
	Domestic Hot Water functioning														
Thermostat setpoint and discharge pressure at cycle end								°F	°C		psig	kPa			
Cooling Mode	Suction Pressure / Discharge Pressure												psig	kPa	
	Duct Return, Indoor Out, and Delta T								In		Out		°F	°C	
	Thermostat setpoint and suction pressure at cycle end								°F	°C		psig	kPa		

UNIT STARTUP (HYDRONIC)

The unit is now ready to be started. The steps below outline the procedure for starting the unit and verifying proper operation of the unit. **It is recommended that safety glasses be worn during the following procedures.**



ENSURE UNIT IS CHARGED WITH REFRIGERANT BEFORE TURNING THE POWER ON. STARTING A COMPRESSOR UNDER VACUUM WILL DESTROY IT IN A MATTER OF SECONDS, VOIDING THE WARRANTY. IF THE UNIT IS NOT FULLY CHARGED, THE REMAINDER CAN BE ADDED DURING HEATING MODE STEP 2.



Preparation:

1. Remove the caps from the service ports and connect a refrigeration manifold set to the unit.
2. Turn the power on to the heat pump and set the thermostat to OFF. Set up the thermostat as per the instructions provided with it so that it will function properly with the heat pump system (set for heat pump, not for heating and cooling). The O signal should be set to active in cooling mode.
3. Measure the following voltages on the compressor contactor and record them on the startup sheet: L1-L2, L2-L3, L1-L3.

Heating Mode:

1. Set the heating aquastat setpoints to activate Stage 2. The compressor will start as well as the indoor circulator pumps.
2. Check the refrigeration gauges. The suction and discharge pressures will depend on the loop temperatures, but they should be about **75-95PSIG** and **290-365PSIG** respectively for a typical start-up. If the unit was not completely charged, add the remaining refrigerant through the suction side only.
3. Monitoring the refrigeration gauges while the unit runs. Record the following data at the time interval(s) indicated: Numbers 1 to 4, record at 10, 15, 20, 25, 30 and then average the values. Record numbers 5 to 8 at 30 minutes. The average superheat for each line set should be **8-14°F (4-8°C)**. The TXV's are set to four turns in (from all the way out) at the factory and typically should not require any adjustments. Should adjustment be required, follow the Heating TXV Adjustment procedure in this manual. Proceed to Step 4 once adjustments have been completed.
 1. Suction pressure
 2. Discharge pressure
 3. Each loop Vapour Line temperature
 4. Each loop superheat (Vapour line temperature - evaporating temperature (from suction gauge)
 5. Indoor Loop In (Hot In) temperature
 6. Indoor Loop Out (Hot Out) temperature
 7. Indoor Delta T (should be between **8-12°F, 4-6°C**)
 8. Compressor L1(C) current (black wire, place meter between electrical box and compressor)
4. Adjust the aquastat setpoint to the desired buffer tank temperature and let the unit run through a cycle. Record the setpoint and the discharge pressure when the unit shuts off.
5. For units with a desuperheater, turn the power off to the unit. Connect the brown wire with the blue insulated terminal to the compressor contactor as shown in the electrical box diagram. Turn the power to the unit on.
6. Verify the DHW IN and DHW OUT temperatures (if applicable) by hand (**caution: pipes get hot**). If the DHW OUT line does not become hotter than the DHW IN line the circulator is air locked. Bleed the air from the system and check the temperature differential again to ensure there is flow from the circulator.

Cooling Mode:

1. Set the thermostat to cooling mode and adjust the setpoint to activate Stage 1 and Stage 2.
2. Monitoring the refrigeration gauges while the unit runs. Record the following after 10 minutes of runtime:
 1. Suction pressure
 2. Discharge pressure
 3. Indoor Loop In (Hot In) temperature
 4. Indoor Loop Out (Hot Out) temperature
 5. Indoor Delta T
3. Adjust the cooling aquastat setpoints to the desired tank temperature, and allow the unit to run through a cycle. Record the aquastat setpoint and the suction pressure when the unit shuts off.

Final Inspection:

1. Turn the power off to the unit and remove all test equipment.
2. Install the electrical box cover and the access panel on the heat pump. Install the service port caps securely to prevent refrigerant loss.
3. Do a final check for leaks in the indoor loop system and ensure the area is clean.
4. Leave a copy of the Startup Record at the installation site, send a copy to AMERICAN DREAM Geothermal and keep the final copy.
5. Turn the power on to the unit. Set the aquastats to the final settings and record the values.

Startup Record —2-5 Ton Two-Stage R410a

Installation Site		Startup Date	Installer	
City			Company	
Province		Check boxes unless asked to record data. Circle data units.	Model	
Country			Serial #	

PRE-START INSPECTION

Indoor Loop (Hydronic)	All shut-off valve are open (full flow available)					
	Loop is full and purged of air					
	Antifreeze type					
	Antifreeze concentration		% Volume	% Weight		
	Loop static pressure		PSI	kPa		
Line Sets	Connected to proper ports, insulated and secured in place					
Domestic Hot Water	All shut-off valves are open					
	Lines are full and purged					
	Desuperheater pump wire is disconnected					
Electrical	High voltage connections are correct and securely fastened					
	Circuit breaker (or fuse) size and wire gauge for Heat Pump		A		Ga.	
	Circuit breaker (or fuse) size, wire gauge, and Plenum Heater size		A		Ga.	kW
	Low voltage connections are correct and securely fastened					
Unit Charge	Refrigerant charge be fore power is turned on		Lbs	kg		

STARTUP DATA

Preparation	Voltage across L1 and L2, L1 and L3, L2 and L3														VAC
	Final refrigerant charge									Lbs	kg				
Heating Mode	Suction	Discharge	V1	S1	V2	S2	V3	S3	V4	S4	V5	S5	V6	S6	
	10 minutes														
	15 minutes														°F
	20 minutes														°C
	25 minutes														
	30 minutes														
	Average														
	Indoor In (Hot In), Indoor Out (Hot Out), and Delta T									In		Out		°F	°C
	Compressor L1 (black wire) current									A					
	Domestic Hot Water functioning														
Heating aquastat setpoint and discharge pressure at cycle end									°F	°C		psig	kPa		
Cooling Mode	Suction Pressure / Discharge Pressure												psig	kPa	
	Indoor In (Hot In), Indoor Out (Hot Out), and Delta T									In		Out		°F	°C
	Cooling aquastat setpoint and suction pressure at cycle end									°F	°C		psig	kPa	
Final Aquastat Settings	Heating S1 Setpoint, S1 Delta, S2 Setpoint, S2 Delta												°F	°C	
	Cooling S1 Setpoint, S1 Delta, S2 Setpoint, S2 Delta												°F	°C	

Heating TXV Adjustment

If it is determined during the start up procedure that one or more of the heating TXV's need to be adjusted, the following procedure and record sheet should be used to ensure that adjustments are recorded and performed in a systematic way. **TABLE 17** describes what each of the columns in the Heating TXV record sheet table represents.

TABLE 17 - TXV Adjustment Record Column Descriptions	
Column	Description
Time Actual	Actual time of the reading
Time EL	Elapsed time since the first reading
Common S	Suction pressure
Common ET	Evaporating temperature (from suction gauge or P/T chart)
Common D	Discharge pressure
Loop P	Loop TXV position. (Number of turns in from all the way out)
Loop V	Loop Vapour Line temperature
Loop S	Loop Superheat (Vapour Line temperature - Evaporating temperature)
TXV #	The TXV that is being adjusted
Turns	The number of turns the TXV is being adjusted
In/Out	The direction the TXV is being adjusted (In=clockwise, OUT=counter-clockwise)

The heating TXV's are set to four turns in from all the way out at the factory. This should be sufficient for most installations, however it is sometimes necessary to make adjustments if the ground conditions vary or if the loop lengths vary. The procedure below explains how to properly adjust the TXV's so that the task can be completed in the minimum amount of time.

- The goal is to obtain a superheat value of **8-14°F (4-8°C)** on each evaporator loop. It is good practice to average out the last few readings as the TXV's tend to cycle, causing the superheat to vary.
- Adjusting a TXV **in** (clockwise) increases the superheat of its evaporator loop. Adjusting a TXV **out** (counter-clockwise) decreases the superheat of its evaporator loop.
- Adjusting one TXV affects the remaining evaporator loops, adjustments must be small and done to only one TXV at a time.
- Adjustments are done every other time interval (ie every 10 minutes). The next two intervals should be averaged together for the next adjustment.
- Always adjust the TXV that is the furthest out.

ADJUSTMENT PROCEDURE

1. Fill in the information section at the top of the adjustment record sheet. Circle °F or °C at the top right.
2. Record all data for the initial readings (elapsed time 0). Adjust the TXV for the loop that is the furthest out. Record the number of the TXV, how much it was adjusted in turns (ie 1/4, 1/2, 1), and in which direction it was adjusted. Record the new position of the adjusted TXV in the appropriate P column of the next row. Record the remaining TXV positions in their individual P columns in the next row.
3. At the next time interval, record the data in the current row. Verify that the superheat of the adjusted TXV has changed in the desired direction. Do not adjust the TXV. Mark — in the TXV #, Turns, and In/Out columns.
4. At the next time interval, record all data. Adjust the TXV that is the furthest out. Record the TXV #, Turns and In/Out values. Record the new position of the adjusted TXV in the appropriate P column of the next row. Record the remaining TXV positions in their individual P columns in the next row.
5. Repeat Steps 2 and 3 until all superheat values are within **8-14°F (4-8°C)**.

[illegible]

General Maintenance

GENERAL MAINTENANCE SCHEDULE		
Item	Interval	Procedure
Air Filter	6 months	Inspect for dirt. Replace if necessary.
Contactor	1 year	Inspect for pitted or burned points. Replace if necessary.
Condensate Drain	1 year	Inspect for clogs. Remove and clean if necessary.
Circulator Pumps	1 years	Inspect for leaks. Repair or replace if necessary.

Troubleshooting Guide

The following steps are for troubleshooting the geothermal heat pump. If the problem is with the domestic hot water or the plenum heater, proceed to those sections at the end of the troubleshooting guide. Repair procedures and reference refrigeration circuit diagrams can be found at the end of the troubleshooting guide.

STEP 1: Verify that the display is present on the thermostat. If it is not, proceed to POWER SUPPLY TROUBLESHOOTING, otherwise proceed to STEP 2.

STEP 2: Remove the door and electrical box cover and check to see if the HI or LOW LED's are flashing or on. Record The results . Turn the power off, wait 10 seconds and turn the power back on. Set the thermostat to call for heating or cooling depending on the season, or set the aquastat to call for heating.

STEP 3 (Air): If a 24VAC signal does not appear across Y1 and C of the FCTF Control Box Thermostat terminal strip within 6 minutes, proceed to the THERMOSTAT TROUBLESHOOTING section, otherwise proceed to STEP 4.
Note that the aquastat should be set so there is no call from it.

STEP 3 (Hydronic): If a 24VAC signal does not appear across Y1A and CA of the DXTF Two Stage Control Box Aquastat terminal strip, proceed to the HYDRONIC TROUBLESHOOTING - AQUASTAT section, otherwise proceed to STEP 4.
Note that the thermostat should be set to off.

STEP 4: If the appropriate signal from STEP 3 is not present at the terminal strip in the heat pump, proceed to the DXTF TWO STAGE CONTROL BOX TROUBLESHOOTING section, otherwise proceed to the STEP 5.

STEP 5: If the HI or LOW LEDs flash and the compressor does not attempt to start, proceed to the SAFETY CONTROL TROUBLESHOOTING section, otherwise proceed to STEP 6.

STEP 6: If HI or LOW pressure LED's are not flashing and the compressor does not attempt to start, attempts to start but cannot, starts hard, or starts but does not sound normal, proceed to the COMPRESSOR TROUBLESHOOTING section, otherwise proceed to STEP 7.

STEP 7: If the compressor starts and sounds normal, this means the compressor is OK and the problem lies elsewhere. Proceed to the AIR OPERATION TROUBLESHOOTING section or the HYDRONIC OPERATION TROUBLESHOOTING section.

POWER SUPPLY TROUBLESHOOTING			
Fault	Possible Cause	Verification	Recommended Action
No power to the heat pump	Disconnect switch open (if installed).	Verify disconnect switch is in the ON position.	Determine why the disconnect switch was opened, if all is OK close the switch.
	Fuse blown / Breaker Tripped.	At heat pump disconnect box, voltmeter shows 230VAC on the line side but not on the load side.	Reset breaker or replace fuse with proper size and type. (Time-delay type "D").
No display on thermostat	Blown Primary or Secondary fuse on transformer.	Visually inspect. Remove fuse and check for continuity if in doubt.	Replace fuse.
	Blown fuse on control board.	Visually inspect. Remove fuse and check for continuity if in doubt.	Replace fuse.
	Faulty transformer.	230VAC is present across H1 and H4 of the transformer but 24VAC is not present across X1 and X4 of the transformer.	Replace transformer.
	Faulty wiring between heat pump and thermostat.	24VAC is not present across C and R(R _H) of the thermostat.	Correct the wiring.
	Faulty Thermostat.	24VAC is present across C and R (R _H) of the thermostat but thermostat has no display.	Replace thermostat.

THERMOSTAT TROUBLESHOOTING

Fault	Possible Cause	Verification	Recommended Action
No Y1 signal to heat pump (after 6 minutes)	Incorrect thermostat setup.	Thermostat does not indicate a call for heat. No 24VAC signal present across C and Stage 1 of the thermostat.	Correct the setup.
	Faulty thermostat to heat pump wiring.	24VAC signal present across Stage 1 and C of the thermostat but not present across Y1 and C of the terminal strip.	Correct or replace wiring.
	Faulty thermostat.	No 24VAC between Stage 1 and C of the thermostat when a call is indicated on the thermostat.	Replace thermostat.

TWO STAGE CONTROL BOX TROUBLESHOOTING

Fault	Possible Cause	Verification	Recommended Action
Thermostat or Aquastat signal does not reach Heat Pump terminal strip.	Faulty Mode Select relay.	Trace the circuit of the signal using a voltmeter and drawing 000740SCH. Measure each point to C (gnd) along the path until the faulty component is located. The Mode Select Relay should be energized for water heat.	Replace the head of the relay.
Indoor Loop Circulator does not have power.	Faulty Circulator pump contactor.	Verify 24VAC across the coil of the contactor. Check for appropriate voltage across P1 and P2	Replace contactor.
Fan operates in hydronic heat mode.	Faulty Mode Select Relay.	24VAC is present across pin 1 of the relay and C of the terminal strip.	Replace the head of the relay
Reversing Valve Activated in hydronic heat mode	Faulty Break O relay	24VAC signal present across pin 4 and C.	Replace the relay
Emergency Heat override does not work	Faulty Emergency Heat Relay	24VAC signal present across pin 4 and C.	Replace the relay

SAFETY CONTROLS TROUBLESHOOTING

Fault	Possible Cause	Verification	Recommended Action
High Pressure Control	Faulty High Pressure Control (open). *HP pressures must be at static levels.	Hi LED is flashing. Short H to H on the connector at the left of the control board and verify whether the LED stops flashing or remains flashing.	Replace high pressure control if LED stops flashing, replace control board if it does not.
Low Pressure Control	Faulty Low pressure control (open). * Must be a signal present on Y1 for this test. *HP pressures must be at static levels.	Lo LED is flashing. Short L to L on the connector at the left of the control board and verify whether the LED stops flashing or remains flashing.	Replace low pressure control if LED stops flashing, replace control board if it does not.
	Unit out of refrigerant.	Check static refrigeration pressure of the unit for a very low value.	Locate the leak and repair it. Spray nine, a sniffer and dye are common methods of locating a leak.

COMPRESSOR TROUBLESHOOTING			
Fault	Possible Cause	Verification	Recommended Action
Compressor will not start	Manual High pressure control tripped.	Press the button on the control, it will click when pressed.	Proceed to Operation Troubleshooting.
	Faulty control board.	Hi and Low LED's off, HB is flashing but Y LED is not on, or no 24VAC across Y and C of bottom right connector.	Replace control board.
	Faulty run capacitor. (Single phase only)	Check value with capacitance meter. Should match label on capacitor. Compressor will hum while trying to start and then trip its overload.	Replace if faulty.
	Loose or faulty wiring.	Check all compressor wiring, including inside compressor electrical box.	Fix any loose connections. Replace any damaged wires.
	Faulty compressor contactor.	Voltage on line side with contactor held closed, but no voltage on one or both terminals on the load side. Points pitted or burned. Or, 24VAC across coil but contactor will not engage.	Replace contactor.
	Thermal overload on compressor tripped.	Ohmmeter shows reading when placed across R and S terminals and infinity between C & R or C & S. A valid resistance reading is present again after the compressor has cooled down.	Proceed to Operation Troubleshooting to determine the cause of the thermal overload trip.
	Burned out motor. (open winding)	Remove wires from compressor. Ohmmeter shows infinite resistance between any two terminals. Note: Be sure compressor overload has had a chance to reset. If compressor is hot this may take several hours.	Replace the compressor.
	Burned out motor (shorted windings)	Remove wires from compressor. Resistance between any two terminals is below the specified value.	Replace the compressor.
	Motor shorted to ground.	Remove wires from compressor. Check for infinite resistance between each terminal and ground.	If any terminal to ground is not infinite replace the compressor.
	Seized compressor due to locked or damaged mechanism.	Compressor attempts to start but trips its internal overload after a few seconds. (Run capacitor already verified)	Attempt to "rock" compressor free. If normal operation cannot be established, replace compressor.
Compressor starts hard	Start capacitor faulty. (Single phase only)	Check with capacitance meter. Check for black residue around blowout hole on top of capacitor.	Replace if faulty. Remove black residue in electrical box if any.
	Potential Relay faulty. (Single phase only)	Replace with new one and verify compressor starts properly.	Replace if faulty.
	Compressor is "tight" due to damaged mechanism	Compressor attempts to start but trips its internal overload after a few seconds. Run capacitor has been verified already.	Attempt to "rock" compressor free. If normal operation cannot be established, replace compressor.
	Faulty Stage 2 module.	Verify if 24VAC is present across Y2 and C of the terminal strip.	Replace module if signal is present. Check wiring if signal is not present.
Compressor Stage 2 will not activate			

AIR OPERATION TROUBLESHOOTING - HEATING MODE

Fault	Possible Cause	Verification	Recommended Action
High Discharge Pressure	Air Flow.	See Fan Troubleshooting section.	Correct the problem.
	Heating TXV's adjusted too far closed.	Verify superheat. It should be between 8-14°F (3-8°C). Superheat will be high if TXV's are closed too far.	Adjust TXV to obtain 8-14°F (3-8°C) superheat.
	One or more heating TXV's stuck (too far closed).	Adjusting the TXV does not affect the superheat or the suction pressure.	Adjust the TXV all the way in and out a few times to loosen it. Replace TXV if this does not work.
	Faulty Normally Open solenoid valve (stuck closed).	A click can be heard when the coil is energized but the valve is cold instead of warm.	Replace NO valve.
	Filter-drier plugged.	Feel each end of the filter- drier, it should be the same temperature. If there is a temperature difference then it is plugged. Also causes low suction pressure.	Replace filter-drier.
	Unit is overcharged.	High sub-cooling, low delta T across air coil.	Remove 1/2lb of refrigerant at a time and verify that the discharge pressure reduces.
Surging Discharge Pressure	Heating TXV's adjusted too far closed.	Verify superheat. It should be between 8-14°F (3-8°C). Superheat will be high if TXV is closed too far.	Adjust TXV to obtain 8-14°F (3-8°C) superheat.
Low Suction Pressure	Heating TXV's adjusted too far closed.	Adjusting the TXV does not affect the superheat or the suction pressure. TXV may be frosting up.	Adjust TXV to obtain 8-14°F (3-8°C) superheat.
	One or more heating TXV's stuck (too far closed).	Adjusting the TXV does not affect the superheat or the suction pressure.	Adjust the TXV all the way in and out a few times to loosen it. Replace TXV if this does not work.
	Faulty Normally Open solenoid valve (stuck closed). ** May actually draw a vacuum.**	A click can be heard when the coil is energized but the valve is cold instead of warm.	Replace NO valve.
	Filter-drier plugged.	Feel each end of the filter- drier, it should be the same temperature. If there is a temperature difference then it is plugged. Also causes low suction pressure.	Replace filter-drier.
	Low refrigerant charge.	Check static refrigeration pressure of the unit for a very low value. Low discharge pressure when running.	Locate the leak and repair it. Spray nine, a sniffer and dye are common methods of locating a leak.
	Faulty compressor, not pumping.	Pressures change only slightly from static values when compressor is started.	Replace compressor.

AIR OPERATION TROUBLESHOOTING - HEATING MODE

Fault	Possible Cause	Verification	Recommended Action
Low Suction Pressure (continued)	Loop piping interchanged (ie Loop 1 connected between Vapour 1 and Liquid 2)	Affected TXV's do not seem to operate properly. Switch to cooling mode and verify all liquid line temperatures for each individual loop switch. The liquid line for the loop in use should be warmer than the others. If loops are interchanged, the wrong liquid line will be warmer.	Pump the unit down and swap the interchanged lines.
	Loop field too small	Charge is good, superheats are good, vapor line temperatures are low.	Increase loop size.
High Suction Pressure (may appear to not be pumping)	Leaking reversing valve.	Reversing valve is the same temperature on both ends of body, common suction line is warm, compressor is running hot.	Replace reversing valve.
	Heating TXV's adjusted too far open.	Verify superheat. It should be between 8-14°F (3-8°C). Superheat will be low if TXV's are open too far.	Adjust TXV to obtain 8-14°F (3-8°C) superheat.
	One or more heating TXV's stuck (too far open).	Adjusting the TXV does not affect the superheat of the loop or the suction pressure. Low super heat, low discharge pressure.	Adjust the TXV all the way in and out a few times to loosen it. Replace TXV if this does not work.
	Faulty cooling check valve (leaking)	Also low discharge pressure. Switch to cooling mode. Unit operates correctly when loop is in use. Loop lines get cold when loop not in use instead of warming to ambient, compressor frosts up.	Identify the check valve. Try switching modes a few times. Replace if problem continues.
Compressor frosting up	See Low Suction Pressure in this section.		
Heating TXV frosting up heavily	TXV stuck almost closed or partially blocked by foreign object.	Adjusting the TXV does not affect the superheat or the suction pressure.	Adjust the TXV all the way in and out a few times to loosen it. Replace TXV if this does not work.
Random high pressure trip (does not occur while on site)	Intermittent fan.	See Fan Troubleshooting section.	Correct the problem.
Random manual high pressure trip (does not occur while on site)	Faulty compressor contactor.	Points pitted or burned. Contactor sometimes sticks causing the compressor to run without the fan, tripping the high pressure control.	Replace contactor.

AIR OPERATION TROUBLESHOOTING - COOLING MODE

Fault	Possible Cause	Verification	Recommended Action
Heating instead of cooling	Thermostat not set up properly.	Verify that there is 24VAC across O/B/W1 and C of the terminal strip when calling for cooling.	Correct thermostat setup. Change to a different thermostat.
High Pressure control trips	Faulty reversing valve solenoid coil.	Verify solenoid by removing it from the shaft while the unit is running. There should be a loud "whoosh" sound when it is removed. Discharge pressure will continue to rise even if there is a loop switch.	Replace solenoid if faulty.
	Faulty reversing valve.	A click can be heard when the coil is energized but hot gas is still directed to the air coil. Discharge pressure will continue to rise even if there is a loop switch.	Replace reversing valve.
	Faulty Loop Pressure switch	Loop LED does not come on around 480PSIG . Shorting S and S causes the LED to come on.	Replace loop pressure switch.
	Faulty Loop Pressure switch Input	Shorting S and S does not cause the Loop Switch LED to come on, or does not cause a loop change.	Replace the control board.
High Pressure control and manual high pressure control trips (very fast)	Faulty reclaim valve solenoid.	Verify solenoid by removing it from the shaft while energized. If there is no click the solenoid is bad	Replace reclaim solenoid coil.
	Faulty reclaim valve.	A click can be heard when the valve is selected but the unit still trips out.	Replace the reclaim valve
	Faulty control board output. (L1 to L5).	Loop LED does not come on or there is no 24VAC across the loop output and C of the control board when the loop is selected.	Replace the control board.
Loop changes occur too frequently	Cooling TXV adjusted too far closed or stuck or partially blocked	Continuous loop changing (every 7 seconds) in two loop mode, high suction pressure, hot compressor.	Adjust TXV or replace if faulty.
	Unit overcharged.	Frequent loop changes. Switch to heating mode to confirm.	Remove refrigerant 1/2 pound at a time in heating mode.
	Loop field saturated	Frequent loop changes in two loop mode after some season runtime.	Install soaker hose.
	Loop field too small	Frequent loop changes in two loop mode after some season runtime.	Increase loop size.

AIR OPERATION TROUBLESHOOTING - COOLING MODE

Fault	Possible Cause	Verification	Recommended Action
High Suction Pressure (may appear to not be pumping)	Cooling TXV adjusted too far open.	Verify superheat. It should be between 8-12°F (3-6°C). Superheat will be low if TXV is open too far.	Adjust TXV to obtain 8-12°F (3-6°C) superheat.
	Cooling TXV stuck open.	Adjusting the TXV does not affect the superheat or the suction pressure. Low super heat and discharge pressure.	Adjust the TXV all the way in and out a few times to loosen it. Replace TXV if this does not work.
	Leaking reversing valve.	Reversing valve is the same temperature on both ends of body, common suction line is warm, compressor is running hot.	Replace reversing valve.
	Leaking reclaim valve.	Scavenger line remains hot where it enters the common suction line.	Replace reclaim valve.
Low Suction Pressure	Air Flow	See Fan Troubleshooting section. Note: low airflow will cause the air coil to ice up once the suction drops below 90PSIG .	Correct the problem.
	Cooling TXV stuck almost closed or partially blocked by foreign object.	Adjusting the TXV does not affect the superheat or the suction pressure. TXV may be frosting up.	Adjust the TXV all the way in and out a few times to loosen it. Replace TXV if this does not work.
	Low or no refrigerant charge.	Entering air temperature and airflow are good but suction is low. Check static refrigeration pressure of unit for very low value.	Locate the leak and repair it. Spray nine, a sniffer and dye are common methods of locating a leak.
	Leaking cooling check valve	Unit operates correctly when loop is in use. Loop lines get cold when loop not in use instead of warming to ambient, compressor frosts up.	Identify the check valve. Try switching modes a few times. Replace if problem continues.
	Faulty NO solenoid valve coil.	Verify solenoid by removing it from the shaft while the unit is running. There should be an audible click sound if the solenoid is working.	Replace solenoid if faulty.
	Faulty NO solenoid valve.	A click can be heard when the coil is energized. Unused loops stay cold instead of gradually warming to ambient. Compressor frosts up.	Replace NO valve.
	Faulty compressor, not pumping.	Pressures change only slightly from static values when compressor is started.	Replace compressor.
Compressor frosting up	See Low Suction Pressure in this section.		
TXV frosting up	TXV stuck almost closed or partially blocked by foreign object.	Adjusting the TXV does not affect the superheat or the suction pressure.	Adjust the TXV all the way in and out a few times to loosen it. Replace TXV if this does not work.
Random Low Pressure trip (does not occur while there)	Faulty compressor contactor.	Points pitted or burned. Contactor sometimes sticks causing the compressor to run without the fan, tripping the low pressure control.	Replace contactor.
	Intermittent fan.	See Fan Troubleshooting section.	Correct the problem.

FAN TROUBLESHOOTING			
Fault	Possible Cause	Verification	Recommended Action
Low Airflow	Dirty air filter	Inspect.	Replace.
	Dirty air coil.	Inspect.	Clean.
	Poor Ductwork	Measure delta T between supply and return ducts at the unit, it in heating mode, it should not be above 30°F(17°C).	The ECM fan will provide proper airflow up to 0.5 inH2o for 1/2HP motors and 0.7 inH2o for 1HP motors. The ductwork is poorly designed or greatly undersized if the fan motor cannot provide the required airflow.
	Air flow selected on Tap Board is too low.	Check selection on Air Flow Tap Board.	Select a higher setting.
	Air flow reduction is enabled.	AR1 and AR2 are connected with a dry contact.	Air flow reduction may not be feasible with poor ductwork, and/or lower Air Flow selections. Increase settings until unit operates properly.
Fan operating on wrong Stage speed	Fan Control Signal Harness is loose.	Verify that the connector is properly inserted into the fan motor. Gently tug on each wire to verify it is properly inserted into the connector.	Repair any loose connections.
	Faulty Control Signal Harness or faulty motor head.	Measure 24VAC between White (pin 3) and the following at the fan control signal harness (insert probes in connector where wire is inserted, do not unplug the connector): Circulation = Grey (pin 15) Stage 1 = Yellow (pin 6) Stage 2=Yellow/Black (pin14) Stage 3 = Violet (pin 2)	If proper signal isn't present, replace Fan Control Signal Harness. If proper signal is present, replace fan motor head.
Fan not operating or operating intermittently	Fan Control Signal Harness and/or Fan Power Harness is loose.	Verify that the connector is properly inserted into the fan motor. Gently tug on each wire to verify it is properly inserted into the connector.	Repair any loose connections.
	Faulty Control Signal Harness or; Faulty motor head.	Measure 24VAC between White (pin 3) and the following at the fan control signal harness (insert probes in connector where wire is inserted, do not unplug the connector): Circulation = Grey (pin 15) Stage 1 = Yellow (pin 6) Stage 2=Yellow/Black (pin14) Stage 3 = Violet (pin 2)	If proper signal isn't present, replace Fan Control Signal Harness. If proper signal is present, replace fan motor head.
	Fan Power Harness faulty or; Faulty motor.	Insert the tips of the voltmeter probes into the back of the connector at the fan to measure the voltage across the red and black wires, value should be 230VAC	Replace Power Harness if 230VAC is not present, replace motor if 230VAC is present

HYDRONIC TROUBLE SHOOTING - AQUASTAT

Fault	Possible Cause	Verification	Recommended Action
No display on aquastat.	Call for heating or cooling from thermostat	Verify thermostat.	None, this is normal operation.
	Blown Primary or Secondary fuse on transformer.	Visually inspect. Remove fuse and check for continuity if in doubt.	Replace fuse.
	Blown fuse on control board.	Visually inspect. Remove fuse and check for continuity if in doubt.	Replace fuse.
	Faulty transformer	230VAC is present across L1 and L3 of the compressor contactor but 24VAC is not present across R and C.	Replace transformer.
	Faulty wiring between heat pump and aquastats.	24VAC is not present across 24V and COM at the top of the aquastat.	Correct the wiring.
	Faulty aquastat.	24VAC is present across 24V and COM of the aquastat but there is no display.	Replace aquastat.
No YA signal to DXTF Control Box	Incorrect aquastat setup.	Aquastat does not indicate S1 on the display.	Correct the setup.
	Faulty aquastat to DXTF Control Box wiring.	24VAC not present across Stage 1 C and COM of the aquastat.	Correct or replace wiring.
	Faulty aquastat to DXTF Control Box wiring.	24VAC signal present across Stage 1 NO and COM of the aquastat but not present across YA and CA of the DXTF Control Box terminal strip.	Correct or replace wiring.
	Faulty aquastat.	No 24VAC between Stage 1 NO and COM of the aquastat when S1 is indicated on the aquastat display.	Replace aquastat.
No BA signal to DXTF Control Box	Incorrect aquastat setup.	Aquastat does not indicate S2 on the display.	Correct the setup.
	Faulty aquastat to DXTF Control Box wiring.	24VAC not present across Stage 2 C and COM of the aquastat.	Correct or replace wiring.
	Faulty aquastat to DXTF Control Box wiring.	24VAC signal present across Stage 2 NO and COM of the aquastat but not present across BA and CA of the DXTF Control box terminal strip.	Correct or replace wiring.
	Faulty aquastat.	No 24VAC between Stage 2 NO and COM of the aquastat when S2 is indicated on the aquastat display.	Replace aquastat.
Setting(s) not retained	Faulty aquastat	E2 error message. Can cause the unit to trip a safety control if the setting is too high or low.	Replace aquastat.

HYDRONIC OPERATION TROUBLESHOOTING

Fault	Possible Cause	Verification	Recommended Action
High Discharge Pressure	Aquastat set too high.	Verify aquastat setting	Lower aquastat setting to recommended value of 115°F (46°C)
	Low or no Indoor loop flow.	Delta T across the Indoor Loop ports should be between 8-12°F (3-6°C), or compare pressure drop to the tables for the unit.	Verify contactor is on and pump is working and sized correctly. Check for restrictions in the circuit, ie valve partially closed.
	Heating TXV's adjusted too far closed.	Verify superheat. It should be between 8-14°F (3-8°C). Superheat will be high if TXV's are closed too far.	Adjust TXV to obtain 8-14°F (3-8°C) superheat.
	One or more heating TXV's stuck (too far closed).	Adjusting the TXV does not affect the superheat or the suction pressure.	Attempt to adjust the TXV all the way out and all the way in a few times to loosen it. Replace TXV if this does not work.
	Faulty Normally Open solenoid valve (stuck closed).	A click can be heard when the coil is energized but the valve is cold instead of warm.	Replace NO valve.
	Filter-drier plugged.	Feel each end of the filter- drier, it should be the same temperature. If there is a temperature difference then it is plugged. Also causes low suction pressure.	Replace filter-drier.
	Unit is overcharged.	High sub-cooling, low delta T across air coil.	Remove 1/2lb of refrigerant at a time and verify that the discharge pressure reduces.
Surging Discharge Pressure	Heating TXV's adjusted too far closed.	Verify superheat. It should be between 8-14°F (3-8°C). Superheat will be high if TXV's are closed too far.	Adjust TXV to obtain 8-14°F (3-8°C) superheat.
Low Suction Pressure	Fan operating when it should be off.	Verify 0VAC across one or both of the following pairs and C in the DXTF Control Box: G1-G2, M1-M2, E1-E2.	If 24VAC is across both terminals of any of the pairs and C, trace the circuit with a voltmeter and replace the faulty component.
	Heating TXV's adjusted too far closed.	Adjusting the TXV does not affect the superheat or the suction pressure. TXV may be frosting up.	Attempt to adjust the TXV all the way out and all the way in a few times to loosen it. Replace TXV if this does not work.
	One or more heating TXV's stuck (too far closed).	Adjusting the TXV does not affect the superheat or the suction pressure.	Attempt to adjust the TXV all the way out and all the way in a few times to loosen it. Replace TXV if this does not work.
	Faulty Normally Open solenoid valve (stuck closed). ** May actually draw a vacuum.**	A click can be heard when the coil is energized but the valve is cold instead of warm.	Replace NO valve.
	Filter-drier plugged.	Feel each end of the filter- drier, it should be the same temperature. If there is a temperature difference then it is plugged. Also causes low suction pressure.	Replace filter-drier.
	Low refrigerant charge.	Check static refrigeration pressure of the unit for a very low value. Low discharge pressure when running.	Locate leak and repair it. Spray nine, a sniffer and dye are common methods of locating a leak.

HYDRONIC OPERATION TROUBLESHOOTING

Fault	Possible Cause	Verification	Recommended Action
Low Suction Pressure (continued)	Faulty compressor, not pumping.	Pressures change only slightly from static values when compressor is started.	Replace compressor.
	Loop piping interchanged (ie Loop 1 connected between Vapour 1 and Liquid 2)	Affected TXV's do not seem to operate properly. Switch to cooling mode and verify all liquid line temperatures for each individual loop switch. The liquid line for the loop in use should be warmer than the others. If loops are interchanged, the wrong liquid line will be warmer.	Pump the unit down and swap the interchanged lines.
	Loop field too small	Charge is good, superheats are good, vapor line temperatures are low.	Increase loop size.
High Suction Pressure (may appear to not be pumping)	Leaking reversing valve.	Reversing valve is the same temperature on both ends of body, common suction line is warm, compressor is running hot.	Replace reversing valve.
	Heating TXV's adjusted too far open.	Verify superheat. It should be between 8-14°F (3-8°C). Superheat will be low if TXV's are open too far.	Adjust TXV to obtain 8-14°F (3-8°C) superheat.
	One or more heating TXV's stuck (too far open).	Adjusting the TXV does not affect the superheat of the loop or the suction pressure. Low super heat, low discharge pressure.	Attempt to adjust the TXV all the way out and all the way in a few times to loosen it. Replace TXV if this does not work.
	Faulty cooling check valve (leaking)	Also low discharge pressure. Switch to cooling mode. Unit operates correctly when loop is in use. Loop lines get cold when loop not in use instead of warming to ambient, compressor frosts up.	Identify the check valve. Try switching modes a few times. Replace if problem continues.
Compressor frosting up	See Low Suction Pressure in this section.		
Heating TXV frosting up heavily	TXV stuck almost closed or partially blocked by foreign object.	Adjusting the TXV does not affect the superheat or the suction pressure.	Attempt to adjust the TXV all the way out and all the way in a few times to loosen it. Replace TXV if this does not work.
Random high pressure trip (does not occur while on site)	Intermittent Indoor circulator.	Verify wiring is good	Correct the wiring or replace the circulator.
Random manual high pressure trip (does not occur while on site)	Faulty compressor contactor.	Points pitted or burned. Contactor sometimes sticks causing the compressor to run without the fan, tripping the high pressure control.	Replace contactor.

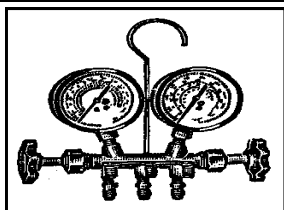
PLENUM HEATER TROUBLE SHOOTING			
Fault	Possible Cause	Verification	Recommended Action
No 230VAC across plenum heater L1 and L2	Disconnect switch open. (if installed)	Verify disconnect switch is in the ON position.	Determine why the disconnect switch was opened, if all is OK close the switch.
	Fuse blown / Breaker Tripped.	At plenum heater disconnect box (if installed), voltmeter shows voltage on the line side but not on the load side. Check if breaker is tripped.	Reset breaker or replace fuse at plenum heater disconnect box. Replace fuse with proper size and type. (Time-delay type "D")
	Same "Line" to L1 and L2	Measuring L1 to ground and L2 to ground both yield 115VAC, but L1 to L2 yields 0VAC.	Correct wiring.
No W2 signal at Heat pump terminal strip	No call for auxiliary or emergency heat from thermostat.	Verify that the thermostat is indicating that auxiliary or emergency heat should be on.	Set thermostat to engage auxiliary or emergency heat (note some thermostats require a jumper between auxiliary and emergency. Check the thermostat manual).
	Faulty thermostat.	Thermostat doesn't indicate a call for auxiliary or emergency when it should.	Replace thermostat.
	Faulty thermostat.	Thermostat indicates auxiliary or emergency but no 24VAC signal present across C and the auxiliary and/or emergency pin at the thermostat.	Replace thermostat.
	Faulty thermostat wiring.	24VAC signal is present across C and the auxiliary and/or emergency pin at the thermostat but no 24VAC signal is present across W2 and C at the heat pump terminal strip.	Correct wiring.
No 24VAC signal from C to ground at the plenum heater control connector	Plenum Heater transformer is burned out.	Voltmeter does not show 24VAC across transformer secondary winding.	Replace transformer.
	Plenum heater control board is faulty.	Transformer tested OK in previous step.	Replace control board.
No 24VAC signal from 1 to ground at the plenum heater control connector	Faulty wiring.	24VAC present across C and ground at the plenum heater, but not across ground of the plenum heater and 1 of the heat pump terminal strip	Correct wiring.
	Faulty wiring.	If previous step tested OK, 24VAC is present across ground of the plenum heater and 1 of the heat pump terminal strip, but not across ground of the plenum heater and 1 of the plenum heater.	Correct wiring.

PLENUM HEATER TROUBLE SHOOTING

Fault	Possible Cause	Verification	Recommended Action
No 24VAC signal from 1 to ground at the plenum heater control connector	Faulty Plenum Heater Relay in heat pump	24VAC is present across pin 1 and pin 3 of the relay, 24VAC is present from heat pump terminal strip 1 to plenum heater ground, but not from heat pump terminal strip 1 to plenum heater ground.	Replace relay.
Thermal overload is tripped.	Fan not operating.	See Fan Not Operating section.	Correct problem. Reset thermal overload.
	Faulty overload	Reset thermal overload	Replace if faulty.

DOMESTIC HOT WATER (DHW) TROUBLE SHOOTING

Fault	Possible Cause	Verification	Recommended Action
Insufficient hot water (Tank Problem)	Thermostat on hot water tank set too low. Should be set at 120°F. (140°F if required by local code)	Visually inspect the setting.	Readjust the setting to 120°F. (140°F if required by local code)
	Breaker tripped, or fuse blown in electrical supply to hot water tank.	Check both line and load sides of fuses. If switch is open determine why.	Replace blown fuse or reset breaker.
	Reset button tripped on hot water tank.	Check voltage at elements with multimeter.	Push reset button.
Insufficient hot water (Heat Pump Problem)	Circulator pump not operating.	Visually inspect the pump to see if shaft is turning. Use an amprobe to measure current draw.	Replace if faulty.
	Blockage or restriction in the water line or hot water heat exchanger.	Check water flow and power to pump. Check water lines for obstruction	Remove obstruction in water lines. Acid treat the domestic hot water coil.
	Faulty DHW cutout (failed open).	Check contact operation. Should close at 120°F and open at 140°F.	Replace DHW cutout if faulty.
	Heat pump not running enough hours to make sufficient hot water.	Note the amount of time the heat pump runs in any given hour.	Temporarily turn up the tank thermostats until colder weather creates longer run cycles.
Water is too hot.	Faulty DHW cutout (failed closed).	Check contact operation. Should close at 120°F and open at 140°F.	Replace DHW cutout if faulty.
	Thermostat on hot water tank set too high. Should be set at 120°F. (140°F if required by local code)	Visually inspect the setting.	Readjust the setting to 120°F. (140°F if required by local code)

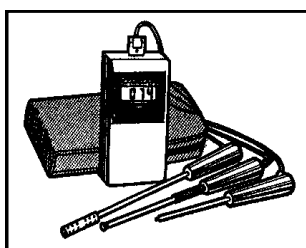


Refrigeration

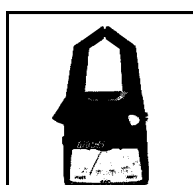


In-line Flowmeter

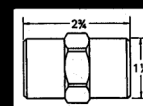
Trouble Shooting Tools



Digital



Multimeter - Voltmeter /



Dole flow control Valve

The Dole® flow control is a simple, self-cleaning device designed to deliver a constant volume of water from any outlet whether the pressure is 15 psig or as high as 125 psi. The controlling mechanism consists of a flexible orifice that varies its area inversely with pressure so that a constant flow is maintained.

REPAIR PROCEDURES

PUMP DOWN PROCEDURE

STEP 1	Connect the refrigerant recovery unit to the heat pump service ports via a refrigeration charging manifold and to a recovery tank as per the instructions in the recovery unit manual. If there was a compressor burn out, the refrigerant cannot be reused and must be disposed of according to local codes.
STEP 2	Ensure all hose connections are properly purged of air. Start the refrigerant recovery as per the instructions in the recovery unit manual.
STEP 3	Allow the recovery unit suction pressure to reach a vacuum. Once achieved, close the charging manifold valves. Shut down, purge and disconnect the recovery unit as per the instructions in its manual. Ensure the recovery tank valve is closed before disconnecting the hose to it.
STEP 4	Connect a nitrogen tank to the charging manifold and add nitrogen to the heat pump until a positive pressure of 5-10PSIG is reached. This prevents air from being sucked into the unit by the vacuum when the hoses are disconnected.
STEP 5	The heat pump is now ready for repairs. Always ensure nitrogen is flowing through the system during any soldering procedures to prevent soot buildup inside the pipes. AMERICAN DREAM Geothermal recommends replacing the liquid line filter-drier anytime the refrigeration system has been exposed to the atmosphere.

VACUUM AND CHARGING PROCEDURE

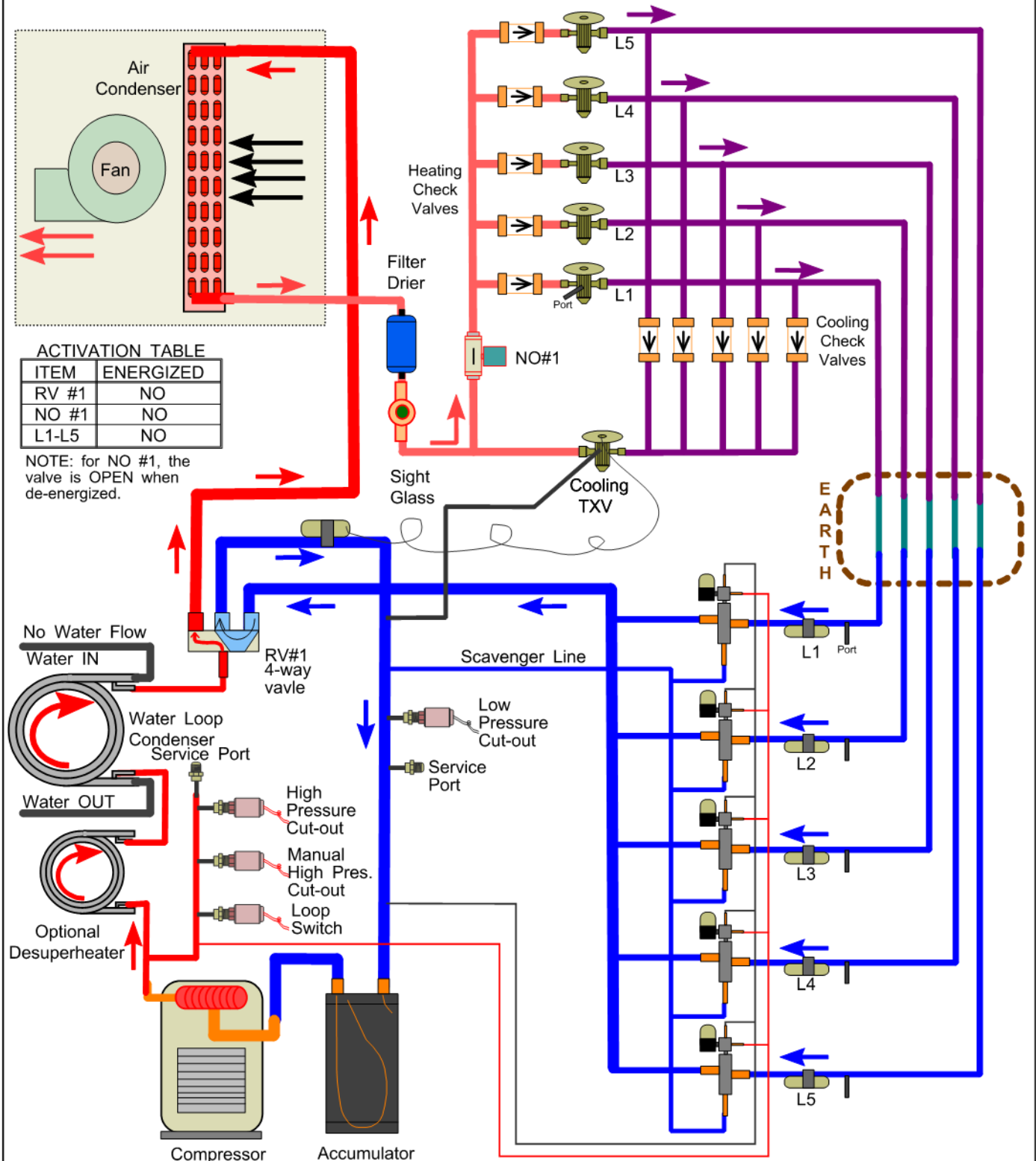
STEP 1	After completion of repairs and nitrogen pressure testing, the refrigeration circuit is ready for vacuuming.
STEP 2	Release the refrigerant circuit pressure and connect the vacuum pump to the charging manifold. Start the vacuum pump and open the charging manifold valves. Vacuum until the vacuum gauge remains at less than 500 microns for at least 1 minute with the vacuum pump valve closed.
STEP 3	Close the charging manifold valves then shut off and disconnect the vacuum pump. Place a refrigerant tank with the proper refrigerant on a scale and connect it to the charging manifold. Purge the hose to the tank.
STEP 4	Weigh in the appropriate amount of refrigerant through the low pressure (suction) service port. Refer to the label on the unit or the Charging The system section for the proper charge amount.
STEP 5	If the unit will not accept the entire charge, the remainder can be added through the low pressure service port after the unit has been restarted.

REPLACEMENT PROCEDURE FOR A COMPRESSOR BURN-OUT

STEP 1	Pump down the unit as per the Pump Down Procedure above.
STEP 2	Replace the compressor. Replace the liquid line filter-drier.
STEP 3	Vacuum the unit until it remains under 500 microns for several minutes with the vacuum pump valve closed.
STEP 4	Charge the unit and operate it for continuously for 2 hours. Pump down the unit and replace the filter-drier. Vacuum the unit until it remains under 500 microns for several minutes with the vacuum pump valve closed.
STEP 5	Charge the unit (refrigerant can be re-used) and operate it for 2-3 days. Pump down the unit and replace the filter-drier.
STEP 6	Charge the unit (refrigerant can be re-used) and operate it for 2 weeks. Pump down the unit and replace the filter-drier.
STEP 7	Charge the unit a final time. Unit should now be clean and repeated future burn-outs can be avoided.

REFRIGERATION CIRCUIT DIAGRAMS

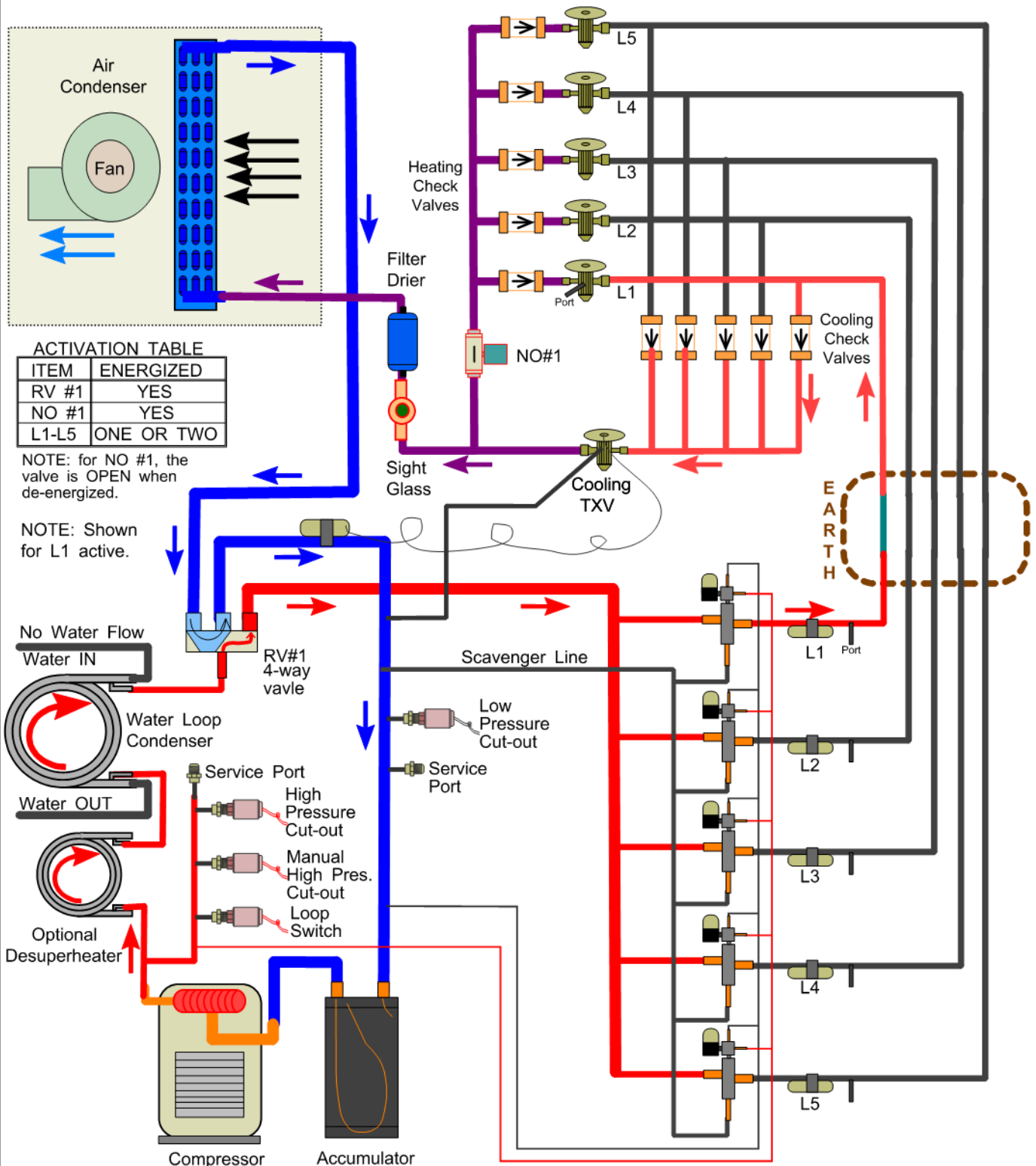
FCTF-Series Refrigeration Circuit - Heating Mode



					Drawn By Chris Geddes	Date 30 AUG 06	AMERICAN DREAM Geothermal			3960 Howard Hughes Pkwy Las Vegas, Nevada 89169-4644
					Checked By Chris Geddes	Date 30 AUG 06	Drawing Name			FCTF-Series Refrigeration Circuit
					Approved By (ENG) Chris Geddes	Date 30 AUG 06	Diagram - Heating Mode			
					Approved By (MFG)	Date	Size	Drawing Number	REV	SHEET
01	Initial Release	C. GEDDES	C. GEDDES	30 AUG 06	Approved By	Date	A	000268RCD	01	1 of 1
REV	ECO #	IMPL BY	APVD BY	DATE						

REFRIGERATION CIRCUIT DIAGRAMS (continued)

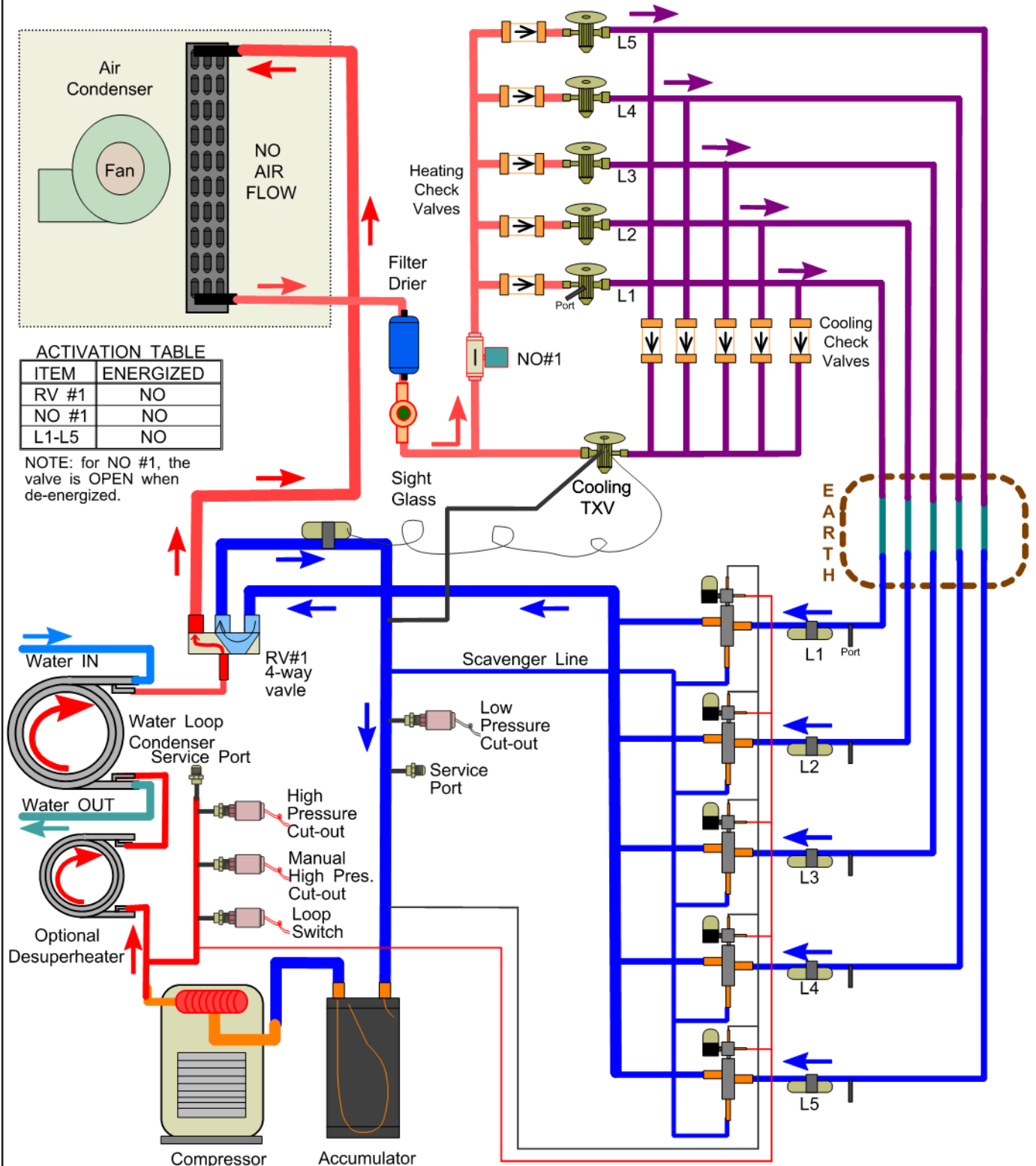
FCTF-Series Refrigeration Circuit - Cooling Mode



					Drawn By Chris Geddes	Date 30 AUG 06	AMERICAN DREAM Geothermal			3960 Howard Hughes Pkwy Las Vegas, Nevada
					Checked By Chris Geddes	Date 30 AUG 06	E4Z 6H4			
					Approved By (ENG) Chris Geddes	Date 30 AUG 06	Drawing Name			FCTF-Series Refrigeration Circuit
					Approved By (MFG)	Date	Diagram - Cooling Mode			
01	Initial Release	C. GEDDES	C. GEDDES	30 AUG 06	Approved By	Date	Size A	Drawing Number 000269RCD	REV 01	SHEET 1 of 1
REV	ECO #	IMPL BY	APVD BY	DATE						

REFRIGERATION CIRCUIT DIAGRAMS (continued)

FCTF-Series Refrigeration Circuit - Water Heating Mode



					Drawn By Chris Geddes	Date 30 AUG 06	AMERICAN DREAM Geothermal			3960 Howard Hughes Pkwy Las Vegas, Nevada 89169
					Checked By Chris Geddes	Date 30 AUG 06	Drawing Name			FCTF-Series Refrigeration Circuit
					Approved By (ENG) Chris Geddes	Date 30 AUG 06	Diagram - Water Heating Mode			
					Approved By (MFG)	Date	Size	Drawing Number	REV	SHEET
01	Initial Release	C. GEDDES	C. GEDDES	30 AUG 06	Approved By	Date	A	000270RCD	01	1 of 1
REV	ECO #	IMPL BY	APVD BY	DATE						

Model Specific Information

This section provides general information particular to each model. For complete specifications please see the specifications document for the desired model

STANDARD CAPACITY RATINGS

The tables below depict the results of standard capacity rating tests according to ARI 870-2005. Stage 1 values do not apply to single stage units. Refer to the [Electrical Tables](#) to determine which models are single stage.

Table 18 - Standard Capacity Ratings - Heating 60Hz								
EAT 70°F (21.1°C)				STAGE 1 - VAPOUR LINE 41°F (5°C) STAGE 2 - VAPOUR LINE 32°F (0°C)				
Model	Size	Mode	Airflow		Input Energy	Capacity		COP _H
	Tons		CFM	L/s	Watts	BTU/Hr	kW	W/W
45	3	Stage 1	1200	566	1,525	23,800	7.0	4.57
		Stage 2	1400	661	2,285	31,100	9.1	3.99
55	4	Stage 1	1400	661	2,330	34,300	10.1	4.32
		Stage 2	1700	802	3,375	43,500	12.7	3.78
65	5	Stage 1	1700	802	2,930	41,900	12.3	4.19
		Stage 2	2100	991	4,180	53,300	15.6	3.74

Table 19 - Standard Capacity Ratings - Cooling 60Hz								
EAT 80°F (26.7°C)				STAGE 1 - LIQUID LINE 68°F (20°C) STAGE 2 - LIQUID LINE 77°F (25°C)				
Model	Size	Mode	Airflow		Input Energy	Capacity		EER
	Tons		CFM	L/s	Watts	BTU/Hr	kW	BTU/W-Hr
45	3	Stage 1	1200	566	1,190	33,700	9.9	28.3
		Stage 2	1400	661	2,240	43,200	12.6	19.3
55	4	Stage 1	1400	661	1,620	40,900	12.0	25.2
		Stage 2	1700	802	2,900	51,500	15.1	17.8
65	5	Stage 1	1700	802	2,055	49,700	14.6	24.2
		Stage 2	2100	991	3,620	63,900	18.7	17.6

Table 20 - Standard Capacity Ratings - Hydronic Heating 60Hz										
EWT 104°F (40°C)					VAPOUR LINE 32°F (0°C)					
Model	Size	Indoor Liquid Flow			Indoor Pressure Drop		Input Energy	Capacity		COP _H
	Tons	IGAL	USG	L/s	PSI	kPA	Watts	BTU/Hr	kW	W/W
45	3	8	9.6	0.61	4.5	31.0	2,210	22,800	6.7	3.02
							3,030	29,700	8.7	2.87
55	4	10	12.0	0.76	5.8	40.0	2,775	30,400	8.9	3.21
							3,875	40,600	11.9	3.07
65	5	12	14.4	0.91	4.8	33.1	3,655	38,900	11.4	3.12
							4,865	49,000	14.4	2.95

CAPACITY RATINGS

3 Ton **Heating Mode (Nominal 3 ton)** R410a 60 Hz

Source Data (Outdoor Loop)			Power Consumption					Sink Data (Indoor Loop)						
Suction Pressure	Evap. Temp	HAB	Compressor		Fan*	Total Electrical	COPh	Discharge Pressure	Cond. Temp.	EAT	Air Flow	LAT	Delta T	Net Output
PSIG	°F	BTU/Hr	Watts	Amps	Watts	Watts	W/W	PSIG	°F	°F	CFM	°F	°F	BTU/Hr
kPa	°C	Watts						kPa	°C	°C	L/sec	°C	°C	Watts
62	10	17,610	1,939	8.5	180	2,119	3.44	305	97	70.0	1,400	86.7	16.7	24,840
430	-12.2	5,160						2104	36.1	21.1	661	30.4	9.3	7,278
70	15	19,204	1,996	8.7	180	2,176	3.59	314	99	70.0	1,400	87.9	17.9	26,630
484	-9.4	5,627						2165	37.2	21.1	661	31.1	10.0	7,803
79	20	20,790	2,080	9.1	180	2,260	3.70	328	102	70.0	1,400	89.2	19.2	28,502
543	-6.7	6,092						2259	38.9	21.1	661	31.8	10.7	8,351
88	25	22,475	2,165	9.5	180	2,345	3.81	342	105	70.0	1,400	90.5	20.5	30,479
605	-3.9	6,585						2357	40.6	21.1	661	32.5	11.4	8,930
97	30	25,716	2,220	9.8	180	2,400	4.14	352	107	70.0	1,400	92.8	22.8	33,907
672	-1.1	7,535						2424	41.7	21.1	661	33.8	12.7	9,935
108	35	27,900	2,280	10.0	180	2,460	4.32	361	109	70.0	1,400	94.4	24.4	36,297
743	1.7	8,175						2492	42.8	21.1	661	34.7	13.6	10,635
119	40	30,025	2,372	10.5	180	2,552	4.45	377	112	70.0	1,400	96.1	26.1	38,733
819	4.4	8,797						2597	44.4	21.1	661	35.6	14.5	11,349
131	45	32,256	2,467	10.9	180	2,647	4.57	392	115	70.0	1,400	97.8	27.8	41,289
900	7.2	9,451						2705	46.1	21.1	661	36.5	15.4	12,098

Compressor: ZPS30K4E-PFV

* @ 37.3Pa (0.15inH2o) Ext. Static

3 Ton **Cooling Mode** R410a 60 Hz

Source Data (Indoor Loop)									Power Consumption					Sink Data (Outdoor Loop)		
Suct. Pres.	Evap. Temp	EAT	Air Flow	LAT	Delta T	Latent	Sensible	HAB	Compressor		Fan*	Total Electrical	Efficiency	Disch. Pres.	Cond. Temp.	Net Output
PSIG	°F	°F	CFM	°F	°F	BTU/Hr	BTU/Hr	BTU/Hr	Watts	Amps	Watts	Watts	EER	PSIG	°F	BTU/Hr
kPa	°C	°C	L/sec	°C	°C	Watts	Watts	Watts					COPc	kPa	°C	Watts
141	49.5	80.0	1,400	61.7	18.3	15,075	31,525	46,600	1,650	7.0	190	1,840	25.3	237	80	52,879
969	9.7	26.7	661	16.5	10.2	4,417	9,237	13,654					7.42	1,631	26.7	15,493
141	49.5	80.0	1,400	62.2	17.8	14,703	30,748	45,451	1,771	7.4	190	1,961	23.2	255	85	52,143
969	9.7	26.7	661	16.8	9.9	4,308	9,009	13,317					6.79	1,761	29.4	15,278
141	49.5	80.0	1,400	62.6	17.4	14,326	29,958	44,284	1,895	7.9	190	2,085	21.2	275	90	51,401
969	9.7	26.7	661	17.0	9.7	4,197	8,778	12,975					6.22	1,899	32.2	15,060
143	50	80.0	1,400	62.9	17.1	14,066	29,414	43,480	2,026	8.5	190	2,216	19.6	296	95	51,042
987	10.0	26.7	661	17.2	9.5	4,121	8,618	12,739					5.75	2,044	35.0	14,955
143	50	80.0	1,400	62.4	17.6	12,580	29,006	41,586	2,118	9.0	190	2,308	18.0	319	100	49,465
987	10.0	26.7	661	16.9	9.8	3,686	8,499	12,185					5.28	2,196	37.8	14,493
143	50	80.0	1,400	62.9	17.1	12,211	28,155	40,366	2,259	9.6	190	2,449	16.5	342	105	48,723
987	10.0	26.7	661	17.2	9.5	3,578	8,249	11,827					4.83	2,357	40.6	14,276
143	51	80.0	1,400	63.5	16.5	11,787	27,179	38,966	2,469	10.5	190	2,659	14.7	377	112	48,042
987	10.3	26.7	661	17.5	9.2	3,454	7,963	11,417					4.29	2,597	44.4	14,076
143	51	80.0	1,400	63.8	16.2	11,555	26,643	38,198	2,565	10.9	190	2,755	13.9	392	115	47,599
987	10.3	26.7	661	17.7	9.0	3,386	7,806	11,192					4.06	2,705	46.1	13,947

Compressor: ZPS30K4E-PFV

* @ 37.3Pa (0.15inH2o) Ext. Static

CAPACITY RATINGS (continued)

4 Ton

Heating Mode (Nominal 4 ton)

R410a 60 Hz

Source Data (Outdoor Loop)			Power Consumption					Sink Data (Indoor Loop)						
Suction Pressure	Evap. Temp	HAB	Compressor		Fan*	Total Electrical	COPh	Discharge Pressure	Cond. Temp.	EAT	Air Flow	LAT	Delta T	Net Output
PSIG	°F	BTU/Hr	Watts	Amps	Watts	Watts	W/W	PSIG	°F	°F	CFM	°F	°F	BTU/Hr
kPa	°C	Watts						kPa	°C	°C	L/sec	°C	°C	Watts
62	10	19,476	2,740	12.0	335	3,075	2.86	319	100	70.0	1,700	88.1	18.1	29,971
430	-12.2	5,707						2196	37.8	21.1	802	31.2	10.0	8,781
70	15	21,698	2,813	12.4	335	3,148	3.02	328	102	70.0	1,700	89.6	19.6	32,441
484	-9.4	6,357						2259	38.9	21.1	802	32.0	10.9	9,505
79	20	24,093	2,885	12.7	335	3,220	3.19	337	104	70.0	1,700	91.2	21.2	35,083
543	-6.7	7,059						2324	40.0	21.1	802	32.9	11.8	10,279
88	25	26,667	2,957	13.0	335	3,292	3.37	347	106	70.0	1,700	92.9	22.9	37,904
605	-3.9	7,813						2390	41.1	21.1	802	33.8	12.7	11,106
97	30	30,965	3,072	13.4	335	3,407	3.66	357	108	70.0	1,700	95.7	25.7	42,594
672	-1.1	9,073						2458	42.2	21.1	802	35.4	14.3	12,480
108	35	34,068	3,147	13.7	335	3,482	3.87	366	110	70.0	1,700	97.7	27.7	45,951
743	1.7	9,982						2526	43.3	21.1	802	36.5	15.4	13,464
119	40	37,377	3,223	14.1	335	3,558	4.08	377	112	70.0	1,700	99.9	29.9	49,519
819	4.4	10,951						2597	44.4	21.1	802	37.7	16.6	14,509
131	45	40,897	3,300	14.4	335	3,635	4.30	387	114	70.0	1,700	102.2	32.2	53,304
900	7.2	11,983						2668	45.6	21.1	802	39.0	17.9	15,618

Compressor: ZPS40K4E-PFV

* @ 37.3Pa (0.15inH2o) Ext. Static

4 Ton

Cooling Mode

R410a 60 Hz

Source Data (Indoor Loop)									Power Consumption					Sink Data (Outdoor Loop)		
Suct. Pres.	Evap. Temp	EAT	Air Flow	LAT	Delta T	Latent	Sensible	HAB	Compressor		Fan*	Total Electrical	Efficiency	Disch. Pres.	Cond. Temp.	Net Output
PSIG	°F	°F	CFM	°F	°F	BTU/Hr	BTU/Hr	BTU/Hr	Watts	Amps	Watts	Watts	EER	PSIG	°F	BTU/Hr
kPa	°C	°C	L/sec	°C	°C	Watts	Watts	Watts					COPc	kPa	°C	Watts
136	47	80.0	1,700	61.2	18.8	16,828	36,807	53,635	2,297	9.8	365	2,662	20.1	237	80	62,721
934	8.3	26.7	802	16.2	10.4	4,931	10,784	15,715					5.90	1,631	26.7	18,377
136	47	80.0	1,700	61.7	18.3	16,422	35,919	52,340	2,447	10.4	365	2,812	18.6	255	85	61,937
934	8.3	26.7	802	16.5	10.2	4,812	10,524	15,336					5.45	1,761	29.4	18,147
136	47.5	80.0	1,700	62.0	18.0	16,163	35,353	51,516	2,601	11.0	365	2,966	17.4	275	90	61,638
934	8.6	26.7	802	16.6	10.0	4,736	10,358	15,094					5.09	1,899	32.2	18,060
138	48	80.0	1,700	62.3	17.7	15,887	34,749	50,636	2,760	11.7	365	3,125	16.2	296	95	61,302
951	8.9	26.7	802	16.8	9.9	4,655	10,181	14,836					4.75	2,044	35.0	17,961
138	48	80.0	1,700	62.6	17.4	13,966	33,377	47,343	2,889	12.3	365	3,254	14.6	319	100	58,448
951	8.9	26.7	802	17.0	9.7	4,092	9,779	13,871					4.26	2,196	37.8	17,125
138	49	80.0	1,700	62.9	17.1	13,686	32,707	46,393	3,059	13.1	365	3,424	13.5	342	105	58,080
951	9.2	26.7	802	17.2	9.5	4,010	9,583	13,593					3.97	2,357	40.6	17,017
141	49	80.0	1,700	63.3	16.7	13,389	31,996	45,385	3,238	13.8	365	3,603	12.6	366	110	57,684
969	9.4	26.7	802	17.4	9.3	3,923	9,375	13,298					3.69	2,526	43.3	16,901
141	49	80.0	1,700	63.9	16.1	12,943	30,931	43,874	3,427	14.6	365	3,792	11.6	392	115	56,816
969	9.4	26.7	802	17.7	9.0	3,792	9,063	12,855					3.39	2,705	46.1	16,647

Compressor: ZPS40K4E-PFV

* @ 37.3Pa (0.15inH2o) Ext. Static

CAPACITY RATINGS (continued)

5 Ton Heating Mode (Nominal 5 ton) **R410a 60 Hz**

Source Data (Outdoor Loop)			Power Consumption					Sink Data (Indoor Loop)						
Suction Pressure	Evap. Temp	HAB	Compressor		Fan*	Total Electrical	COPh	Discharge Pressure	Cond. Temp.	EAT	Air Flow	LAT	Delta T	Net Output
PSIG	°F	BTU/Hr	Watts	Amps	Watts	Watts	W/W	PSIG	°F	°F	CFM	°F	°F	BTU/Hr
kPa	°C	Watts						kPa	°C	°C	L/sec	°C	°C	Watts
62	10	27,054	3,384	14.7	455	3,839	3.06	301	96	70.0	2,100	88.0	18.0	40,155
430	-12.2	7,927						2073	35.6	21.1	991	31.1	10.0	11,765
70	15	29,807	3,484	15.1	455	3,939	3.22	310	98	70.0	2,100	89.4	19.4	43,251
484	-9.4	8,733						2134	36.7	21.1	991	31.9	10.8	12,672
79	20	32,777	3,584	15.5	455	4,039	3.38	319	100	70.0	2,100	90.9	20.9	46,560
543	-6.7	9,603						2196	37.8	21.1	991	32.7	11.6	13,642
88	25	35,969	3,683	15.9	455	4,138	3.55	328	102	70.0	2,100	92.5	22.5	50,092
605	-3.9	10,539						2259	38.9	21.1	991	33.6	12.5	14,677
97	30	39,930	3,712	16.3	455	4,167	3.81	337	104	70.0	2,100	95.3	25.3	54,151
672	-1.1	11,699						2324	40.0	21.1	991	35.2	14.1	15,866
108	35	43,638	3,811	16.7	455	4,266	4.00	347	106	70.0	2,100	97.2	27.2	58,198
743	1.7	12,786						2390	41.1	21.1	991	36.2	15.1	17,052
119	40	47,592	3,912	17.2	455	4,367	4.19	357	108	70.0	2,100	99.2	29.2	62,498
819	4.4	13,944						2458	42.2	21.1	991	37.4	16.2	18,312
131	45	51,799	4,016	17.6	455	4,471	4.39	366	110	70.0	2,100	101.4	31.4	67,060
900	7.2	15,177						2526	43.3	21.1	991	38.5	17.4	19,649

Compressor: ZPS51K4E-PFV

* @ 49.7Pa (0.20inH2o) Ext. Static

5 Ton Cooling Mode **R410a 60 Hz**

Source Data (Indoor Loop)									Power Consumption					Sink Data (Outdoor Loop)		
Suct. Pres.	Evap. Temp	EAT	Air Flow	LAT	Delta T	Latent	Sensible	HAB	Compressor	Fan*	Total Electrical	Efficiency	Disch. Pres.	Cond. Temp.	Net Output	
PSIG	°F	°F	CFM	°F	°F	BTU/Hr	BTU/Hr	BTU/Hr	Watts	Amps	Watts	Watts	EER	PSIG	°F	BTU/Hr
kPa	°C	°C	L/sec	°C	°C	Watts	Watts	Watts					COPc	kPa	°C	Watts
131	45.5	80.0	2,100	63.0	17.0	21,714	43,372	65,086	2,843	12.4	515	3,358	19.4	237	80	76,548
900	7.5	26.7	991	17.2	9.4	6,362	12,708	19,070					5.68	1,631	26.7	22,428
133	46	80.0	2,100	63.3	16.7	21,412	42,767	64,179	3,055	13.2	515	3,570	18.0	255	85	76,364
917	7.8	26.7	991	17.4	9.3	6,274	12,531	18,804					5.27	1,761	29.4	22,375
133	46.5	80.0	2,100	63.5	16.5	21,088	42,121	63,208	3,273	14.0	515	3,788	16.7	275	90	76,137
917	8.1	26.7	991	17.5	9.2	6,179	12,341	18,520					4.89	1,899	32.2	22,308
136	47	80.0	2,100	63.8	16.2	20,743	41,431	62,174	3,498	14.8	515	4,013	15.5	296	95	75,869
934	8.3	26.7	991	17.7	9.0	6,078	12,139	18,217					4.54	2,044	35.0	22,229
136	48	80.0	2,100	62.7	17.3	18,024	42,307	60,331	3,663	15.7	515	4,178	14.4	319	100	74,592
934	8.6	26.7	991	17.1	9.6	5,281	12,396	17,677					4.23	2,196	37.8	21,855
138	48	80.0	2,100	63.0	17.0	17,678	41,496	59,174	3,903	16.7	515	4,418	13.4	342	105	74,254
951	8.9	26.7	991	17.2	9.4	5,180	12,158	17,338					3.92	2,357	40.6	21,756
138	49	80.0	2,100	63.4	16.6	17,312	40,635	57,947	4,155	17.6	515	4,670	12.4	366	110	73,886
951	9.2	26.7	991	17.4	9.2	5,072	11,906	16,978					3.64	2,526	43.3	21,648
141	49	80.0	2,100	63.8	16.2	16,923	39,724	56,647	4,421	18.7	515	4,936	11.5	392	115	73,493
969	9.4	26.7	991	17.6	9.0	4,958	11,639	16,597					3.36	2,705	46.1	21,533

Compressor: ZPS51K4E-PFV

* @ 49.7Pa (0.20inH2o) Ext. Static

ELECTRICAL TABLES

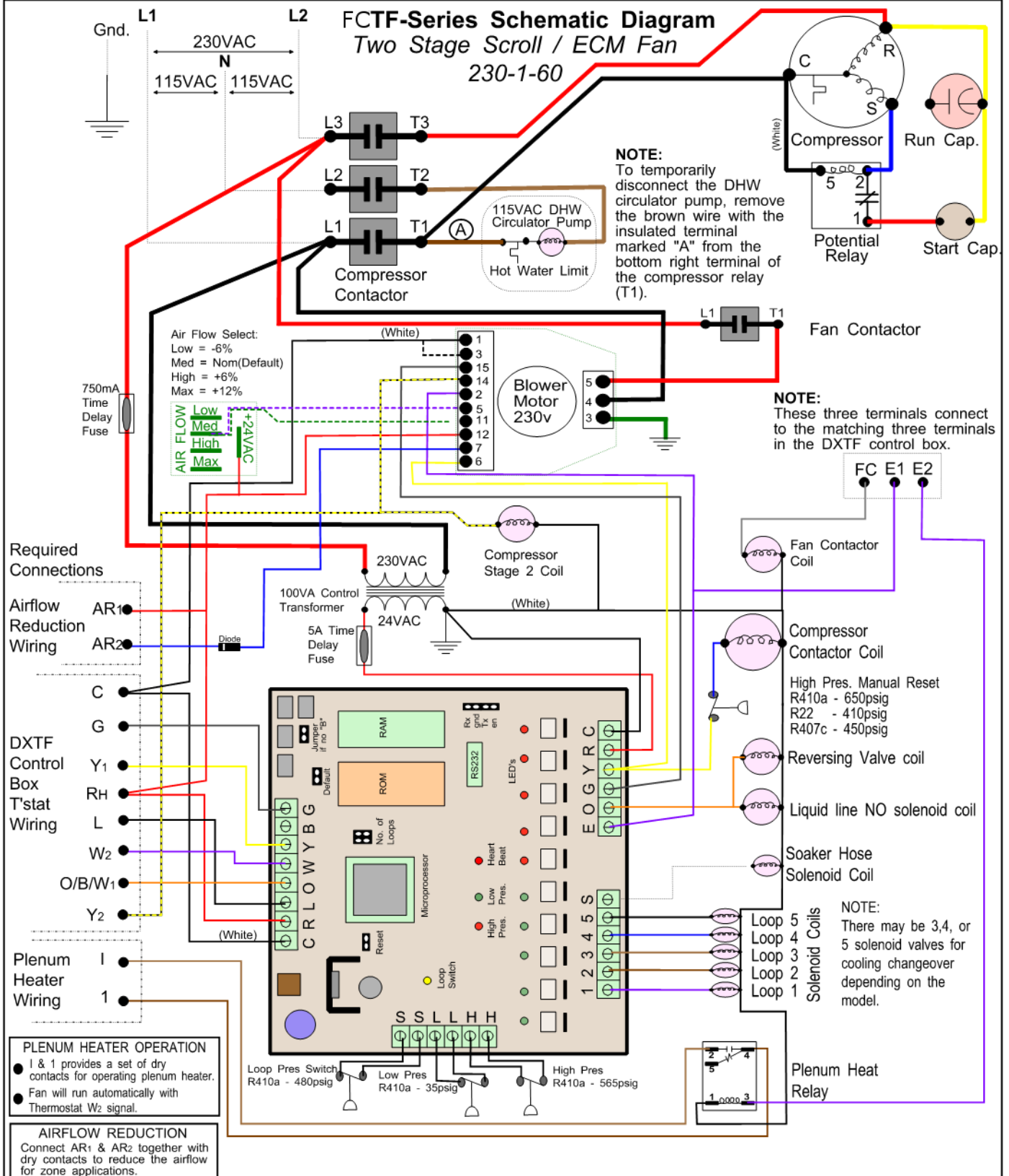
Table 21 - Heat Pump Electrical Information (230-1-60)							
Model	Compressor		Fan	FLA	MCA	Max Fuse/ Breaker	Wire Size
	RLA	LRA	RLA	Amps	Amps	Amps	ga
45	18.6	82	3.5	23.1	27.8	40	#8-3
55	23.6	96	4.0	28.6	34.5	50	#6-3
65	28.6	118	5.5	35.1	42.3	60	#6-3

Table 22 - Heat Pump Electrical Information (208-3-60)							
Model	Compressor		Fan	FLA	MCA	Max Fuse/ Breaker	Wire Size
	RLA	LRA	RLA	Amps	Amps	Amps	ga
45	12.4	58	3.5	16.9	20.0	30	#10-4
55	15.0	88	4.0	20.0	23.8	40	#8-4
65	19.6	123	5.5	26.1	31.0	50	#8-4
* Models are single stage							

Table 23 - Heat Pump Electrical Information (220-1-50)							
Model	Compressor		Fan	FLA	MCA	Max Fuse/ Breaker	Wire Size
	RLA	LRA	RLA	Amps	Amps	Amps	ga
45*	15.0	67	3.5	19.5	23.3	40	#8-2
55*	17.7	98	4.0	22.7	27.1	50	#6-2
65*	27.3	153	5.5	33.8	40.6	60	#6-2
* Models are single stage							

Table 24 - Heat Pump Electrical Information (380-3-50)							
Model	Compressor		Fan	FLA	MCA	Max Fuse/ Breaker	Wire Size
	RLA	LRA	RLA	Amps	Amps	Amps	ga
45	5.0	29	3.5	9.5	10.8	15	#14-4
55	7.1	41	4.0	12.1	13.9	20	#12-4
65	10.0	62	5.5	16.5	19.0	30	#10-4
* Models are single stage							

ELECTRICAL DIAGRAMS (230-1-60)



					Drawn By Chris Geddes	Date 27 MAY 08	AMERICAN DREAM Geothermal			3960 Howard Hughes Pkwy Las Vegas, Nevada	
					Checked By Chris Geddes	Date 27 MAY 08				E4Z 6H4	
02	000143	C. GEDDES	C. GEDDES	25 MAY 09	Approved By Chris Geddes	(ENG) Date 27 MAY 08	Drawing Name FCTF**-HAC**-1T**-DE**				
01	Initial Release	C. GEDDES	C. GEDDES	27 MAY 08	Approved By (MFG)	Date	Schematic Diagram				
REV	ECO #	IMPL BY	APVD BY	DATE	Approved By	Date	Size A	Drawing Number 000737SCH	REV 02	SHEET 1 of 1	

FCTF-Series Electrical Box Diagram
230-1-60 / Two Stage Scroll / ECM Fan

FCTF Two Stage Control Box Wiring

C - 24VAC Common
 G - Fan
 Y1 - Stage 1 Heat/Cool (Compressor)
 RH - 24VAC Hot
 L - Trouble (if available on thermostat)
 W2 - Stage 2 Heat (Plenum Heater)
 O/B/W1 - Reversing Valve (Active in Cooling)
 Y2 - Stage 2 Heat/Cool (Compressor S2 Solenoid Coil)

FC - Fan Contactor
E1 - Emergency Heat In
E2 - Emergency Heat Out

Use an 18-2 conductor cable to connect Electrical Box **AR1 AR2** to dry contacts. Fan speed can be reduced by 15% for zone applications.

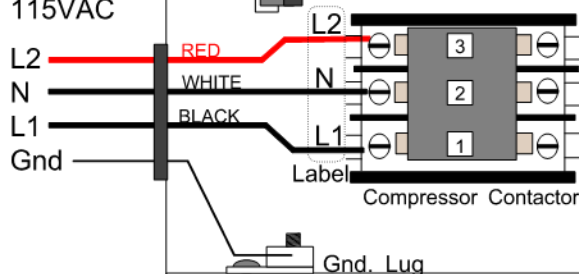
Use an 18-2 conductor cable to connect Electrical Box **I 1** to Plenum Heater **C 1** (or **I 1**).

Note: If heat pump is to be operated without the hot water circulator connected to the water tank and flooded with water, remove the brown wire with the insulated terminal located here. **This pump is water lubricated and must not be run dry.**

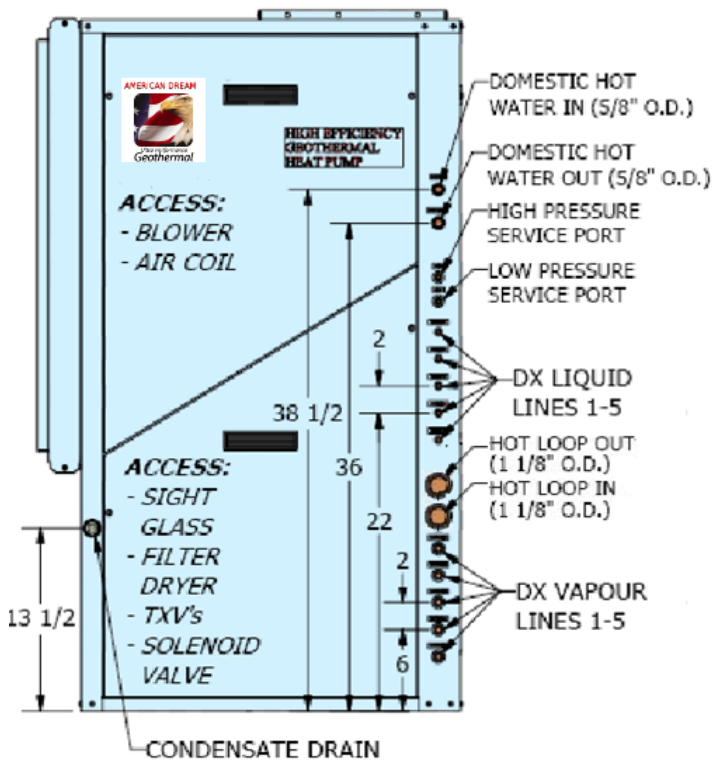
Wire	Colour	Contact
L2	Red	L3
N	White	L2
L1	Black	L1

Connect "Gnd" to Gnd. Lug

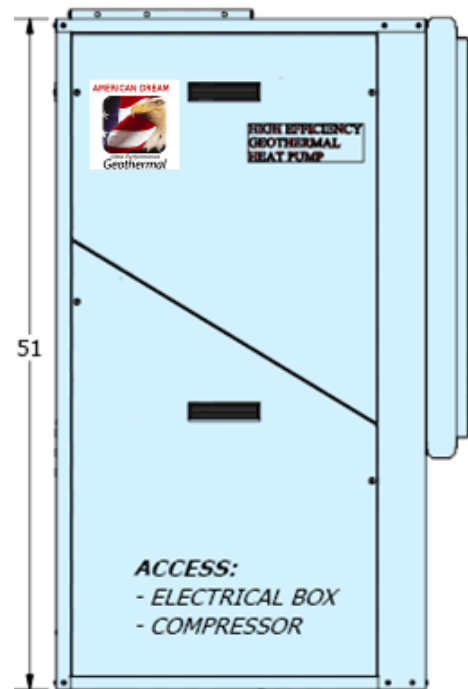
Field
Wiring
230VAC
115VAC

25 MAY 2009

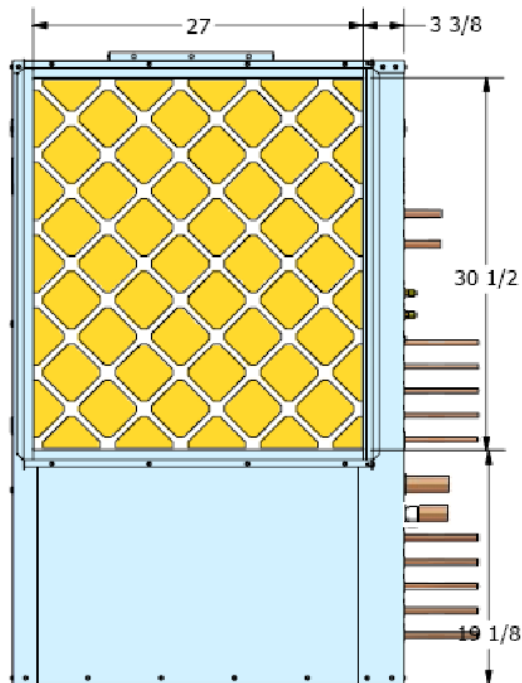
CASE DETAILS



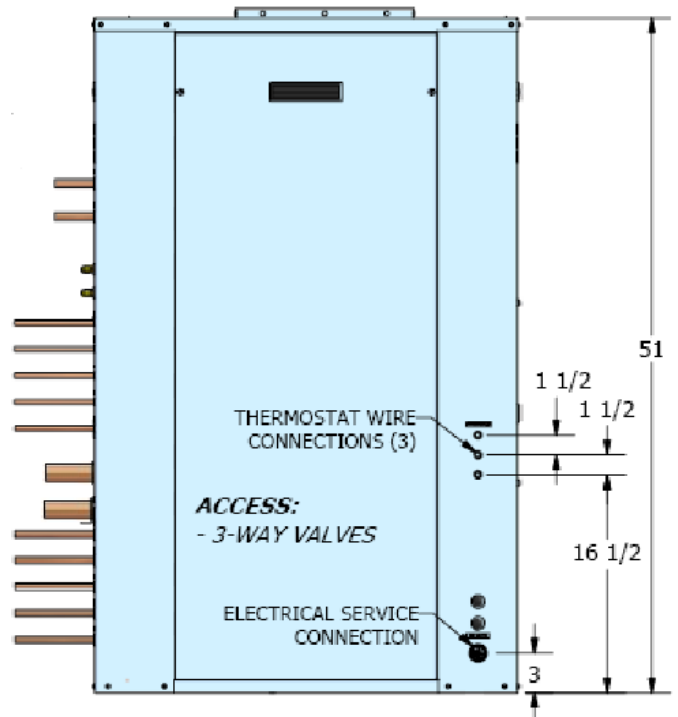
Front View



Back View

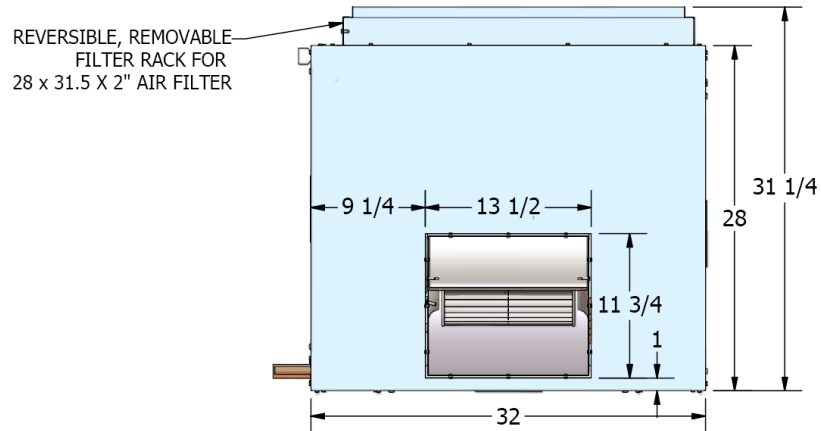


Left Side View

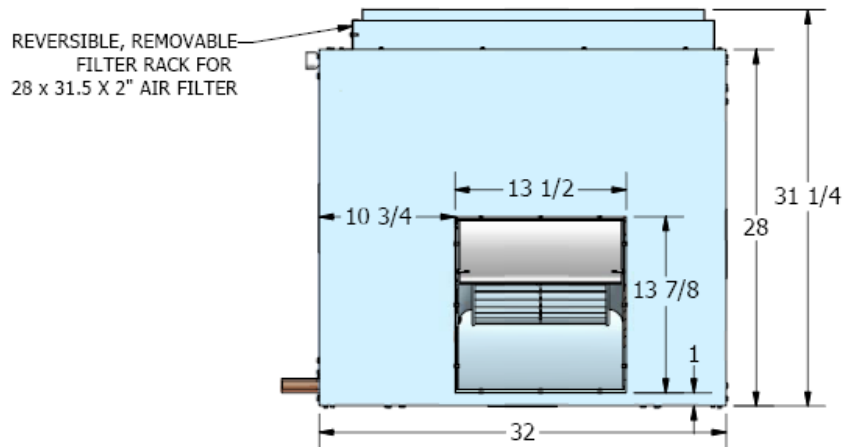


Right Side View

CASE DETAILS (continued)



Top View (Size 2,3,4 Ton)



Top View (Size 5 Ton)

APPENDIX A - ECM Fan Airflow Tables

NOMINAL AIRFLOW SETTING (MED)													
		STAGE 2				STAGE 1				FAN ONLY (Recirculation)			
Model	Nom. Size	Full		Reduced*		Full		Reduced*		Full		Reduced*	
	Tons	CFM	L/s	CFM	L/s	CFM	L/s	CFM	L/s	CFM	L/s	CFM	L/s
25	2	800	378	680	321	680	321	578	273	448	211	381	180
45	3	1200	566	1020	481	1030	486	876	413	672	317	571	270
55	4	1500	708	1275	602	1240	585	1054	497	840	396	714	337
65	5	1900	897	1615	762	1540	727	1309	618	1064	502	904	427
75	6	2100	991	1785	842	1660	783	1411	666	1176	555	1000	472

-6% AIRFLOW SETTING (LOW)													
		STAGE 2				STAGE 1				FAN ONLY (Recirculation)			
Model	Nom. Size	Full		Reduced*		Full		Reduced*		Full		Reduced*	
	Tons	CFM	L/s	CFM	L/s	CFM	L/s	CFM	L/s	CFM	L/s	CFM	L/s
25	2	752	355	639	302	639	302	543	256	421	199	358	169
45	3	1128	532	959	453	968	457	823	388	632	298	537	253
55	4	1410	665	1199	566	1166	550	991	468	790	373	671	317
65	5	1786	843	1518	716	1448	683	1230	581	1000	472	850	401
75	6	1974	932	1678	792	1560	736	1326	626	1105	522	940	443

+6% AIRFLOW SETTING (HIGH)													
		STAGE 2				STAGE 1				FAN ONLY (Recirculation)			
Model	Nom. Size	Full		Reduced*		Full		Reduced*		Full		Reduced*	
	Tons	CFM	L/s	CFM	L/s	CFM	L/s	CFM	L/s	CFM	L/s	CFM	L/s
25	2	848	400	721	340	721	340	613	289	475	224	404	191
45	3	1272	600	1081	510	1092	515	928	438	712	336	605	286
55	4	1590	750	1352	638	1314	620	1117	527	890	420	757	357
65	5	2014	951	1712	808	1632	770	1388	655	1128	532	959	452
75	6	2226	1051	1892	893	1760	830	1496	706	1400	661	1190	562

+12% AIRFLOW SETTING (MAX)													
		STAGE 2				STAGE 1				FAN ONLY (Recirculation)			
Model	Nom. Size	Full		Reduced*		Full		Reduced*		Full		Reduced*	
	Tons	CFM	L/s	CFM	L/s	CFM	L/s	CFM	L/s	CFM	L/s	CFM	L/s
25	2	896	423	762	359	762	359	647	306	502	237	426	201
45	3	1344	634	1142	539	1154	544	981	463	753	355	640	302
55	4	1680	793	1428	674	1389	655	1180	557	941	444	800	377
65	5	2128	1004	1809	854	1725	814	1466	692	1192	562	1013	478
75	6	2352	1110	1999	944	1859	877	1580	746	1317	622	1120	528

NOTES: Unit sizes 25, 45 and 55 nominal value up to 0.50 inH₂O, sizes 65 and 75 up to 0.70 inH₂O

*To obtain the REDUCED airflow values use a dry contact to connect AR1 to AR2 on the terminal strip

INFORMATION TAKEN FROM DOCUMENT 000527INF-03

LIMITED WARRANTY

AMERICAN DREAM Ultra Performance Geothermal warrants that its geothermal heat pumps shall be free from defects in materials and workmanship for a period of FIVE (5) YEARS after the date of installation or for a period of FIVE (5) YEARS AND SIXTY (60) DAYS after the date of shipment, whichever occurs first. This warranty covers all internal components of the heat pump. Please see labor allowance schedule for information pertaining to labor coverage.

AMERICAN DREAM Ultra Performance Geothermal shall, at its option, replace any part covered by this warranty, *shipping cost will apply*. Defective parts shall be returned to AMERICAN DREAM Ultra Performance Geothermal, shipping charges apply. Replacement or repaired parts and components are warranted only for the remaining portion of the original warranty period.

This warranty is subject to the following conditions:

1. The geothermal heat pump must be properly installed and maintained in accordance with AMERICAN DREAM Ultra Performance Geothermal guidelines.
2. The installer must complete the **Startup Record** and return it to AMERICAN DREAM Ultra Performance Geothermal within 21 days of unit installation.
3. For new construction, it is the responsibility of the building or general contractor to supply temporary heat to the structure prior to occupancy. Geothermal heat pumps are designed to provide heat only to the completely finished and insulated structure. Startup of the unit shall not be scheduled prior to completion of construction and final duct installation for validation of this warranty.
4. It is the customer's responsibility to supply the proper quantity and quality of water or properly sized ground loop with adequate freeze protection.

If a geothermal heat pump manufactured by AMERICAN DREAM Ultra Performance Geothermal fails to conform to this warranty, AMERICAN DREAM Ultra Performance Geothermal's sole and exclusive liability shall be, at its option, to replace any part or component which is returned by the customer during the applicable warranty period set forth above, provided that (1) AMERICAN DREAM Ultra Performance Geothermal is promptly notified in writing upon discovery by the customer that such part or component fails to conform to this warranty; (2) the customer returns such part or component to AMERICAN DREAM Ultra Performance Geothermal, shipping charges prepaid, within (30) thirty days of failure, and (3) AMERICAN DREAM Ultra Performance Geothermal's examination of such component discloses to its satisfaction that such part or component fails to conform to this warranty and the alleged defects were not caused by accident, misuse, neglect, alteration, improper installation, repair or improper testing. AMERICAN DREAM Ultra Performance Geothermal will not be responsible for any consequential damages or labor costs incurred. In addition, AMERICAN DREAM Ultra Performance Geothermal will not be responsible for the cost of replacement parts purchased from a third party.